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MONTHLY WEATHER REVIEW.

Editor: Prof. CLEVELAND ABBE. Assistant Editor: FRANK OWEN STETSON.

VOL. XXXIV. AUGUST, 1906. No. 8

The MONTHLY WEATHER REVIEW is based on data from about 3500 land stations and many ocean reports from vessels taking the international simultaneous observation at Greenwich noon.

Special acknowledgment is made of the data furnished by the kindness of cooperative observers, and by Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada; Señor Manuel E. Pastrana, Director of the Central Meteorological and Magnetic Observatory of Mexico; Camilo A. Gonzales, Director-General of Mexican Telegraphs; Capt I. S. Kimball, General Superintendent of the United States Life-Saving Service; Commandant Francisco S. Chaves, Director of the Meteorological Service of the Azores, Ponta Delgada, St. Michaels, Azores; W. N. Shaw, Esq., Secretary, Meteorological Office, London; H. H. Cousins, Chemist, in charge of the Jamaica Weather Office; Señor Anastasio Alfaro, Director of the National Observatory, San José, Costa Rica; Rev. L. Gangoiti, Director of the Meteorological Observatory of Belen College, Havana, Cuba.

As far as practicable the time of the seventy-fifth meridian, which is exactly five hours behind Greenwich time, is used in the text of the MONTHLY WEATHER REVIEW.

Barometric pressures, both at land stations and on ocean vessels, whether station pressures or sea-level pressures, are reduced, or assumed to be reduced, to standard gravity, as well as corrected for all instrumental peculiarities, so that they express pressure in the standard international system of measures, namely, by the height of an equivalent column of mercury at 32° Fahrenheit, under the standard force, i. e., apparent gravity at sea level and latitude 45°.

SPECIAL ARTICLES, NOTES, AND EXTRACTS.

THE INTERNATIONAL SYMBOLS.

By Mr. HENRY HELM CLAYTON. Dated Blue Hill Observatory, Hyde Park, Mass., May 8, 1906.

In the excellent article by Mr. Miller, in the December, 1905, WEATHER REVIEW, Vol. XXXIII, page 524, on the international definitions and symbols, he uses the expression "Silver thaw" as an equivalent of the symbol ∨. The expression "Silver thaw" is a meteorological term used in England, but not in the United States, and I did not know its exact meaning until I had occasion to look it up recently. In the English edition of the report of the Vienna Congress, where the symbols originated in 1874, the expression "Silver thaw" is given as the equivalent of the German "Rauhfrost", indicated by the symbol ∨. "Glazed frost" is given as the equivalent of the German "Glatteis" and indicated by the symbol ⊙⊙. Mr. R. H. Scott, in his "Elementary Meteorology", p. 115, 1887, gives "Silver thaw" and "Glazed frost" as equivalent expressions, and defines them as follows:

> The frozen surface which is occasionally produced at the beginning of a thaw, if a warm wind suddenly sets in. The damp air, passing over the ground, of which the temperature is exceedingly low, has its moisture deposited in the solid form, and all objects on which this deposit takes place are covered with a sheet of ice. This phenomenon is intensified if a fall of rain occurs at the time.

Wind blowing against cold objects does not produce a "sheet of ice"; this is brought about by the second method suggested by Mr. Scott, namely, the falling of raindrops against objects cooled below the freezing point. Mr. William Marriott in his "Hints to Meteorological Observers", 1902, is more specific and defines "Silver thaw", on page 59, as "Rain falling when the air is below the freezing point and congealing when it falls". I find also that Mossman and other English writers use "Silver thaw" in this sense. It is evident from the above that "Silver thaw" is not the equivalent of the German "Rauhfrost". Doctor Hann defines "Rauhfrost" as "a rich, frost-like, rough deposit of ice particles which forms over the irregularities of the earth's surface, on edges, corners, and on the branches and twigs of trees. It is distinguished from frost by the conditions of its formation. Ordinary frost forms on clear nights like the dew, but "Rauhfrost", however, in foggy weather; the latter is formed from the fine fluid fog particles which are cooled below the freezing point, and therefore turn to ice by contact with solid bodies.

It seems evident, from these quotations, that the American term "Frostwork" is equivalent to the German "Rauhfrost", but that the English term "Silver thaw" is equivalent to the American term "Ice storm" and should be defined by the symbol ⊙⊙. I write this to prevent, if possible, the expression "Silver thaw" coming into use as the equivalent of the terms "Frostwork", "Rauhfrost", and "Givre", and thus causing confusion in terminology and description.

THE METEOROLOGICAL OPTICS OF PROF. J. M. PERNTER.

By Prof. R. W. WOOD. Dated Johns Hopkins University, Baltimore, Md., September 15, 1906.

The subjects treated in this volume[1] comprise the various types of halos, parhelia, rainbows, etc.; in fact the entire list of phenomena due to the reflection, refraction, and diffraction of light by clouds, snow crystals, and raindrops suspended in the air. It is doubtful if any type of halo with its accompanying parhelia, and there is a large number of them, has ever been observed which is not explained in this very comprehensive treatise.

The value of Doctor Pernter's book is somewhat marred, in the writer's opinion, by a very peculiar mistake which the author, in common with some other writers on this subject, makes almost at the outset. As is well known, a large number of these optical phenomena can only be explained by assuming an orientation of the ice crystals or spiculæ floating in the air. These may roughly be divided into two types, elongated hexagonal prisms or spiculæ, fig. 2, and flattened hexagonal laminæ, fig. 1, the form usually observed in the case of snowflakes. The author states, on page 318, that a body falling through a resisting medium (the air) orients itself in such a way that the resistance offered by the medium is a *minimum*, i. e., the long spiculæ stand vertically, while the flat plates take a position such that the diagonal of the hexagon points up and down, in other words, stand on end; whereas the true positions are perpendicular to these and are shown in figs. 1 and 2. It seems odd that such a mistake could have been made, since we have so many examples of the principle that a falling body takes the position of *maximum* resistance, mica flakes settling in water, falling leaves and pine needles, an unfeathered arrow, etc. It is evidently not a slip of

[1] Meteorologische Optik von J. M. Pernter. Theil III. Wilhelm Braumueller. Wien und Leipzig.

the pen for, from this point on, the author always considers his spiculæ and plates as standing vertically in the air. The same error was made by Bravais and his predecessors in treating parhelia. It must not be supposed, however, that this error invalidates in any way the author's admirable treatment of the optical problems involved, for in each case we may substitute a horizontal hexagonal plate for a vertical hexagonal prism, and vice versa, without affecting the orientation of the angles. It is well to bear this in mind, as the formation of plates or spiculæ of ice seems to depend upon the temperature, and it is possible that approximate estimates of the temperatures of the clouds could be made by considering whether the parhelia observed were of the type due to hexagonal crystals with the principal axis vertical (i. e., flat plates), or with the axis horizontal (i. e., spiculæ). Erroneous conclusions would of course be drawn if the mistake here pointed out were not corrected.

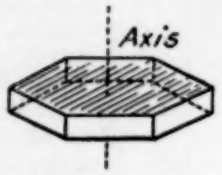

FIG. 1.

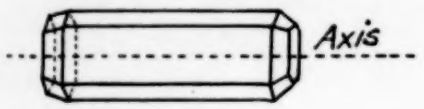

FIG. 2.

The luminous rings often seen surrounding the sun or moon are divided by the author into two classes—halos and coronæ.

(1) The "halos" or large rings, due to ice crystals floating in the air, are commonly seen with a radius of 22° or 46°, rarely with 90°. There are in addition a large number of related phenomena—the horizontal ring, which passes through the sun and runs parallel to the horizon; arcs of circles with their concave sides turned away from the sun; the parhelia (neben sonnen), or brightly luminous spots seen on the halo, to the right and left of, or above and below, the sun. A very complete list, illustrated with diagrams, is given, followed by explanations of each type. As an introduction to the theoretical treatment the author gives us a very complete and profusely illustrated list of the various types of snowflakes and ice spiculæ, and the temperature conditions under which they are formed. Bentley's valuable work[1] on the micro-photography of snow crystals is alluded to, and it seems a pity that some of his beautiful pictures could not have been included in this volume, as they are superior in definition to those used by Pernter to illustrate this section.

The smaller rings, which are more commonly seen, and which are due to diffraction either by water drops or by ice crystals, the author calls "Kränze" [or coronæ or small circles]. They are more often observed around the moon, as the overpowering brilliancy of the sun is usually sufficient to drown them out. When seen surrounding the point opposite the sun, as when the shadow of the observer's head is thrown upon a cloud, they are spoken of as "glories." These latter are to be classed as diffraction phenomena seen in reflected light. Following the glories comes a brief description and explanation of the "Heiligenscheines", a luminous halo seen surrounding the shadow of the observer's head when it is thrown upon dew covered grass, and the so-called iridescent clouds, which are explained in the same way as the smaller halos and glories. I have looked with some interest for some mention of an extremely beautiful and brilliant phenomenon which I once saw upon the surface of a large lake at Madison, Wis. The sun was well up, and the surface of the water appeared to be covered with a very shallow layer of fine mist. About half a mile from shore appeared a long, very narrow, and extremely brilliant straight spectral band, the colors being vivid and arranged in proper order. There were, if I remember rightly, two or more spectra, the appearance being strikingly like the reflection of an arc light in a plane metallic diffraction grating. I have never seen the phenomenon described elsewhere, but quite recently a letter was published in "Nature," describing a very similar appearance seen also upon the surface of a lake[2].

Doctor Pernter's admirable treatment of the rainbow, which is largely his own, is the best, most complete, and most easily understood that has ever been given. There is more variety in rainbows than is commonly supposed. Teachers who are in the habit of contenting themselves with the theory of Descartes will have difficulty in explaining why certain colors are sometimes nearly absent in the rainbow while at other times they may predominate. The difficulty lies in attempting to explain the phenomenon by geometrical optics and rays—wave-front methods are always safer. A plane or flat wave, incident upon a transparent sphere (raindrop), can be shown by very elementary methods to acquire, after two refractions and one reflection, the peculiar shape shown in *b*, fig. 3, where the curved line 1, 2, 3 represents the wave-fronts, the elements of which are traveling in the direction of the arrows. The portion 1, 2 is convex in the direction of propagation, and will of course go on expanding; the part 2, 3 is concave, and converges to a focus. The curvature varies as we pass along the wave-front, being greatest at 3, zero at 2 (where the front is plane) and having a large value again at 1. The element at 3 comes to a focus first, passes through it and becomes convex instead of concave, forming a "cusp" on the wave as shown at *c*. Successive elements of the wave-front above 3 pass in turn through foci and build the rear front of the cusped wave. A fuller treatment of the propagation of cusped waves will be found in my Physical Optics (The MacMillan Co., 1905) where I have shown that the caustic surfaces (i. e., the curved lines of light seen, for example, when light is reflected upon the table cloth by the inside of a napkin ring) are the surfaces traced out by the cusps on the wave-front, where there is of course a concentration of radiant energy. We may thus regard the least deviated ray in the Descartes theory as the path traversed by the cusp on the wave after its emergence from the raindrop.

Now the caustic surfaces are always bordered by interference fringes, for we are dealing with two sets of wave-trains, formed by the front and rear surfaces of the cusped waves. If we draw the surfaces, as in fig. 3, representing the crests of the waves by solid lines, and the troughs by dotted lines, we find that crests intersect troughs along the arrows 1, 3, and 5, consequently these represent the positions of the interference minima. This method of looking at the phenomenon is more elementary than that given by Pernter, who integrates the effect of the whole wave at a given point in front of it, as in diffraction problems. We thus see that in addition to the least deviated ray of Descartes, indicated by the arrow 0, there will be other directions (arrows 2, 4, etc.) in which there is considerable illumination. With a monochromatic sun we should, therefore, have a number of concentric bows, as can be shown experimentally with a spectrometer and glass cylinder or ball. The distance between these bows will vary with the size of the raindrops, and since with white light we have, theoretically, an infinite number of bows, it is clear that the color of the actual rainbow at a given point can only be determined by computing the "mischfarbe" due to the superposed bows. This is not an easy problem, or one that can be described briefly, but the author handles it most skilfully. The variation in the color is of course due to the fact that secondary bows (the interference maxima) are differently spaced in different cases, the distance between them

[1] Monthly Weather Review, Annual Summary, 1902, Vol. XXX, p. 627.

[2] The rainbow as seen in the dewdrop is described by L. J. Briggs, Science, September 19, 1902.

being a function of the size of the drops. A curiously distorted bow, observed by Linhart (Pernter, page 494), is explained by refraction by an intervening bank of mist. This appears to be a wholly inadequate explanation, as the presence of small drops of water in the air [or saturated air] can only affect its refractive index to a very slight degree, if at all. The masts of ships never appear distorted when seen through wisps of fog. A more reasonable way of regarding the phenomenon seems to be to consider the distorted portion as a part of a halo seen upon the cloud bank, the actual rainbow being invisible through the mist.

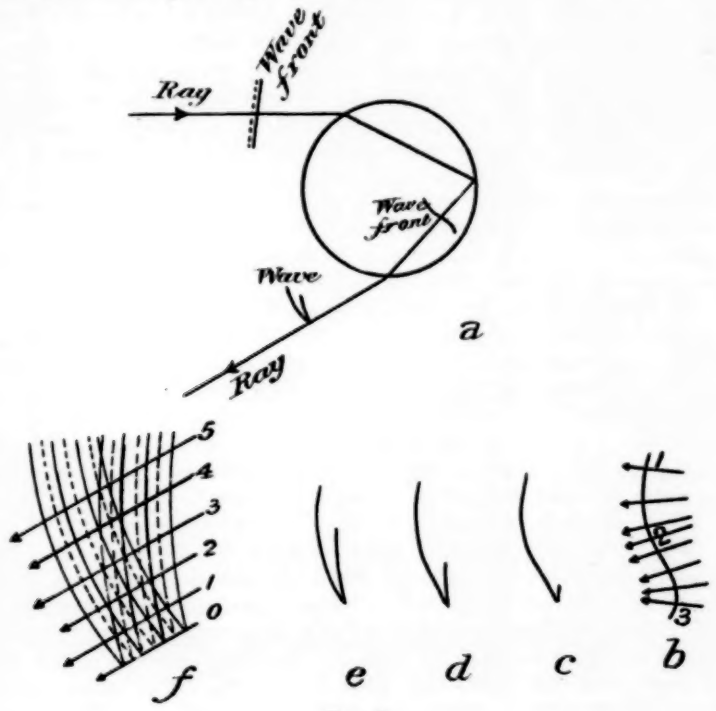

FIG. 3.

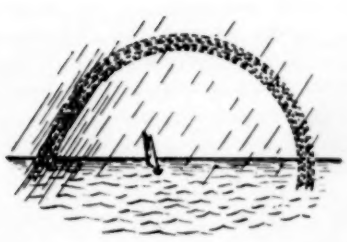

FIG. 4.

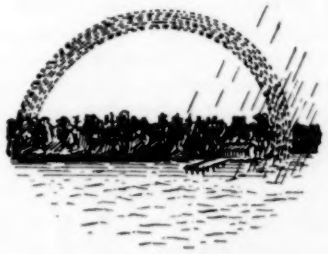

FIG. 5.

Two years ago, while discussing rainbows with Alexander Harrison, who has made an elaborate study of them from the artist's point of view, I was asked for an explanation of why the bow sometimes departed from a true circular arc. Never having observed a case of this kind, or seen any description of one, I expressed some doubt as to whether it were possible. Mr. Harrison assured me, however, that he had frequently seen the lower end of the bow slope off in a nearly straight line (as I have roughly sketched in fig. 4), and had attributed it to the fact that the rain curtain forming this portion was at a greater distance. Only a few weeks ago I observed a magnificent bow at Annisquam, Mass., which showed an unmistakable anomaly of this sort, the left half appearing pulled out into an arc of greater curvature, as shown in fig. 5. The right part cut across a distant bank of trees and well down upon the intervening water, the drops being not over 100 yards distant, while the left portion did not do so, and was evidently formed by a wall of rain at least half a mile away. I have been unable to find any case of this kind mentioned by Pernter. Possibly readers of the MONTHLY WEATHER REVIEW may have observed similar cases. The case which I saw this summer was so marked that it was at once noted by several people, whom I questioned as to whether the bow seemed peculiar in any way. It may be an illusion, similar to the apparent increase in the diameter of the moon when seen on the horizon, but I am inclined to regard it as real. It may be due to the fact that the cusp on the wave does not travel in a straight line, or in other words that the direction of the "least deviated ray" varies with the distance of the drop. It becomes noticeable, however, only when large distances are involved, for I have found that two jets of spray, one 60 feet from the eye and the other three, gave superposed rainbows. I have delayed this review in the hope of having a chance to throw up a jet of spray close to the eye and compare its bow with the one formed by a distant shower, but no more rainbows have appeared as yet.

EIFFEL'S "ETUDES PRATIQUES".

[Translation of a letter from M. Eiffel, dated Paris, France, April 12, 1906.]

In extending you my thanks for the very complete account [by the Editor] of my work, "Practical Studies in Meteorology", which you have been kind enough to publish in the October number of the MONTHLY WEATHER REVIEW, Vol. XXXIII, p. 442, I permit myself to make the following remarks:

1. In reference to the reading of thermometers to the tenth of a degree, I am of the opinion that in the observation of natural phenomena as complex as those studied by meteorologists it is not desirable to seek the precision necessary for the physicist and the chemist in investigating phenomena which are largely of their own creation in their own laboratories, for the reason that such precision would be purely illusory. We may convey an impression of accuracy by calculating, if we will, monthly means to the hundredth of a degree, but this does not constitute any real progress in science. Moreover, in the American observations, tenths of degrees are not observed in reading the maximum and minimum thermometers, from which eventually the mean monthly temperatures are determined.

2. The author of the article does not give my reason for preferring the meteorological year, commencing with December, to the civil year, commencing with January. It is simply in order to enable us to group the months by seasons. In our climates these seasons possess such distinct characteristics that it is advantageous to group the months accordingly, and this can be accomplished only by considering as winter the months of December, January, and February. December must not be classed an an autumn month, nor March as a winter month. It appears to me that such a grouping is useful; that by years combines elements which exhibit wide discrepancies.

3. The division into decades appears to me advantageous because it permits the deduction of means that are not too comprehensive, whereas those for a whole month include elements that are very unequal. In such means the irregularity of the final decades is of scarcely greater importance than that due to months of 31, 30, and 28 days.

4. There must be some misunderstanding as to what is said about mean solar time and the note in reference thereto. I have nowhere considered *true* solar time, but *mean* solar time, either civil or local.

5. I think it a duty to recommend the use of diagrams, especially the last that I have constructed, and two of which refer to the reading of the psychrometer, inasmuch as, when traveling, they replace the more or less voluminous tables, and even for the final reductions made at the office they are more rapid than the tables, as has been found by M. Moureaux, Director of the Observatory of St. Maur, who has made actual time tests. Moreover the diagrams furnish direct solutions

that are not given by the tables; for example, the weight of water vapor when the relative humidity and the temperature are given, or the two temperatures of the psychrometer.

STUDIES ON THE THERMODYNAMICS OF THE ATMOSPHERE.

By Prof. FRANK H. BIGELOW.

VII.—THE METEOROLOGICAL CONDITIONS ASSOCIATED WITH THE COTTAGE CITY WATERSPOUT.

The data that have been collected regarding the meteorological conditions prevailing at the time of the Cottage City waterspout are sufficiently extensive and accurate to enable us to study carefully the causes that produced the phenomenon, and to derive several important results regarding the formation of lofty cumulo-nimbus clouds and the dynamic actions going on within them. In this instance we can compute approximately the forces producing the ascension of the buoyant vapor in the cloud, the formation of hail and the energy working in the vortex at the base of the cloud which developed as the waterspout. I shall proceed to give these facts in detail, as this computation may serve as a type to be followed in discussing other cases of similar local atmospheric action.

Besides the formation and dissipation of the tube, noted in the several reports and shown in figures 27–36, there are special features to which attention must be directed: (1) In the third appearance the vortex tube shows a gradual tapering of the form from the cloud to the sea level, but in the second appearance the tube seems to have about the same diameter from the cloud to the sea level. It is necessary to account for this divergence in the type. (2) The photographs show a peculiar set of boundary curves in the cloud level which depend upon certain dynamic forces that we shall attempt to discover. (3) At the foot of the tube, near the sea level, there was a great commotion of the waters, with a white nucleus just under the tube, and finally a beautiful cascade of imposing dimensions surrounding it. These are topics of especial interest besides those usually considered in discussing such vortices.

The meteorological conditions are given quite fully by the regular observations of the neighboring Weather Bureau stations, Nantucket being a station of the first order and having a continuous barograph and thermograph record; Woods Hole, a station of the second order, with complete daily evening observations; and Vineyard Haven, a station of the third order, with daily temperature, wind, and cloud reports. The daily weather map of 8 a. m., August 19, 1896, exhibits the general conditions for the United States, and from it can be obtained the local conditions prevailing at that hour, at least approximately. The physical appearance of the waterspout has been described fully in the reports already given, and there is also a series of notes of which further use will be made in the proper places. We shall endeavor in this Section, VII, to discuss the scientific problems which are naturally suggested by these data, with the view of illustrating typical methods of treating waterspout and tornado phenomena whenever these occur.

METEOROLOGICAL CONDITIONS FOR AUGUST 19, 1896.

Vineyard Haven, Marthas Vineyard, Mass.—The Journal for this station has been given as the report of W. W. Neifert, the observer, in the preceding Section, VI, page 307, extract A.

Nantucket, Mass.—The Journal for this station has been given as the report of Max Wagner, the observer, on page 309, extract C.

Woods Hole, Mass.—The report for this station has been given as the report of J. D. Blagden, the observer, on page 309, extract D.

This last report also adds:

> Clear during the forenoon, partly cloudy during the afternoon. Thunderstorm: thunder first heard, 1:58 p. m.; loudest, 3:02 p. m.; last, 3:50 p. m. Storm came from the northwest and moved toward the southeast; temperature before the storm 66°, after 67°; direction of the wind before the storm northwest, after, northwest; during the storm the wind shifted to the northeast. Rain began 2:55 p. m.; ended 3:20 p. m.; amount 0.33 inch. Maximum wind velocity 38 miles per hour from the northwest, at 3:00 p. m. A few hailstones fell about 3:10 p. m., and quite a heavy fall of hail was reported a few miles north of this office.

The weather map of August 19, 1896, is represented as fig. 37.

In Section A of Table 50 the meteorological data are given for Woods Hole, Vineyard Haven, and Nantucket on August 19, 1896. They are extracted from Forms 1001–Met'l. of Woods Hole and Nantucket, and Form 1004–Met'l. of Vineyard Haven. The notation is as follows: B=barometric pressure; t=dry-bulb thermometer; t_1=wet-bulb thermometer; d=dew-point; R. H.=relative humidity; e=vapor tension; Max. t and Min. t=maximum temperature and minimum temperature for the periods ending at the respective times of observations; Dir.=direction and Vel.=velocity of the wind; Amt.=amount of precipitation; Amt.=amount; Kind; Dir.=direction from which the clouds came; Local time=hour of making the regular observations.

In Section B are given the meteorological data at the evening observation for ten days immediately preceding, and ten days immediately following the date August 19, 1896, with the purpose of showing the kind of August weather prevailing in that locality.

In Section C are given data at alternate hours obtained from the continuous self-register of the pressure and the temperature for Nantucket during August 19, 1896.

PROBABLE CONDITIONS NEAR THE WATERSPOUT.

The general chart for August 19, 1906, fig. 37, shows that an area of high pressure was central over the upper Lake region, with its eastern edge just overlapping the southern New England coast. This anticyclone was advancing quite rapidly for the summer season, and on the following day, August 20, it extended far eastward over the ocean. The winds were light to fresh from the north and northwest over New England, and the advancing border of the area of high pressure produced a showery condition with precipitation in eastern Maine, the upper St. Lawrence Valley, and on the Massachusetts coast. Later in the day several thunderstorms developed in the neighborhood of Vineyard Sound, such storms being reported as follows, seventy-fifth meridian time:

Station.	Began.	Loudest.	Ended.	Precipitation.
Woods Hole	1:58 p. m.	3:02 p. m.	3:50 p. m.	2:55 to 3:20 p. m.; 0.33 inch.
Vineyard Haven	1:45 p. m.	3:04 p. m.	3:45 p. m.	3:04 to 3:30 p. m.; 0.38 inch.
Nantucket*				2:40 to 4:00 p. m.; 0.03 inch.

**Note by observer at Nantucket, Mass.*—An ordinary thunderstorm was already passing across the sound, when about 12:40 p. m. a huge black tongue shot down from an alto-cumulus cloud that floated half a mile high at the northern edge of the shower.

Several observers mention the thunderstorm that occurred in the neighborhood, in connection with the formation of the waterspout at the base of a large cumulo-nimbus cloud. The day had been generally calm, the breeze being about three to six miles per hour from the northwest. There was a pronounced turbulent congestion of the atmosphere along the southeastern edge of the anticyclone, also a strong convectional movement in the vertical direction, as was indicated by the rapid formation of clouds, the production of precipitation, and the generation of thunderstorms accompanied by an overturning of the strata. All these are consequences attending the flow of cold anticyclonic air over the ocean, causing abnormal temperature stratifications to be superposed upon the ordinary quiet arrangement due to solar insolation taken by itself. The readjustment of the thermal equilibrium, which had become much congested, gave rise to the phenomena

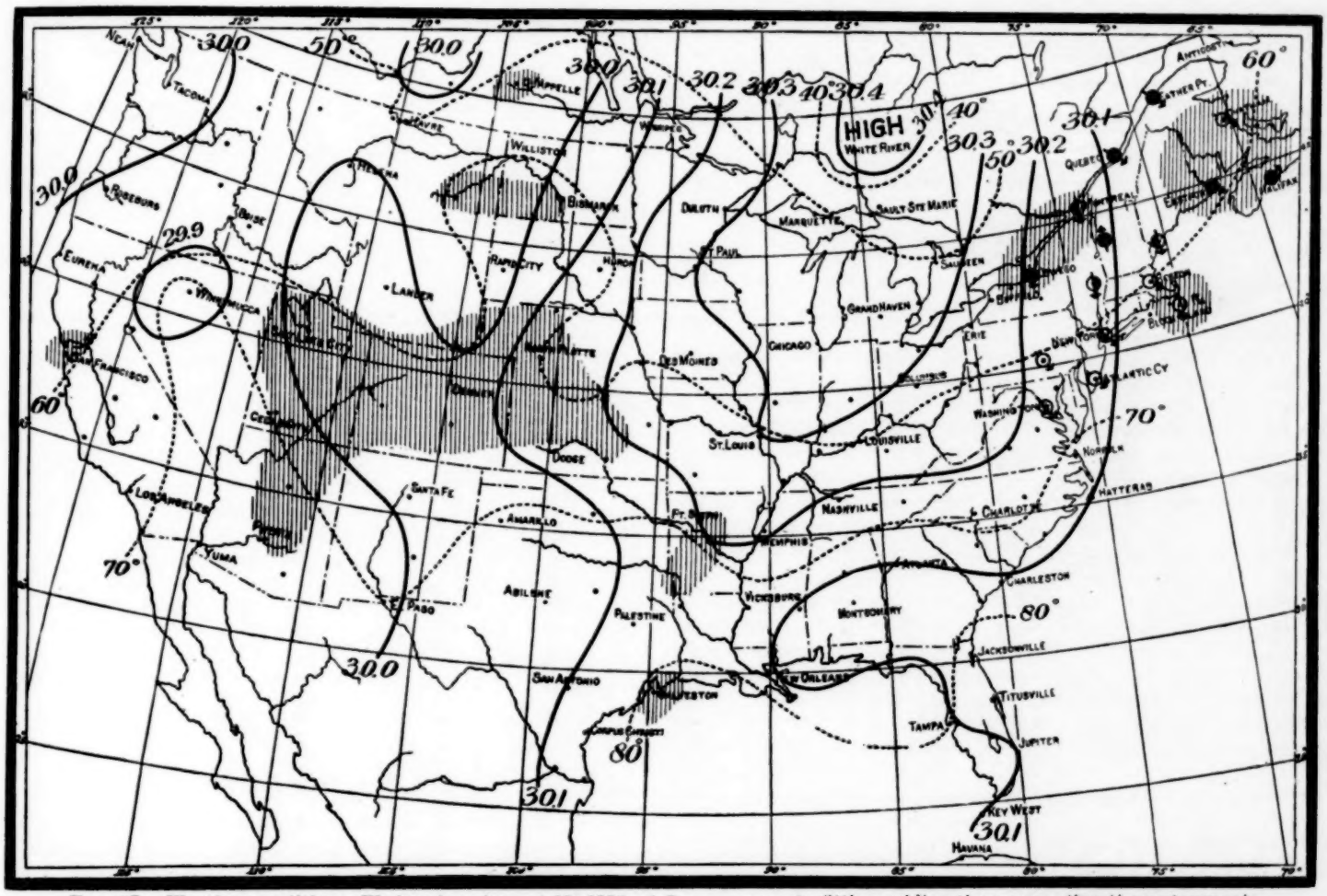

FIG. 37.—Weather conditions, Wednesday, August 19, 1896, at 8 a. m., seventy-fifth meridian time, preceding the waterspout.

observed on the occasion, one of which was the formation of the waterspouts from the base of the same thunderstorm cloud. The vertical convection producing the cloud became vigorous enough to generate vortex tubes during the interval, 12:45 to 1:28 p. m. Similar violent disturbances of the lower atmosphere occur in summer whenever masses of air of very different densities are brought close together, with abrupt changes in the temperatures within short distances. In the Mississippi Valley this usually occurs in the southeast quadrant of a cyclone, where the two streams flow together or overflow one another, one cool and dry from the northwest, the other warm and moist from the south. Near the Atlantic coast the same effect is produced by an anticyclonic area with dry, cool northwest winds pushing forward and protruding the current, flowing freely in the higher levels, over the warm, moist layers of air lying near the surface of the ocean. In all such cases we have a natural thermodynamic engine, where the pressure, volume, temperature (p_1, v_1, T_1) for the "source" of the thermal energy is quite different from (p_0, v_0, T_0) for the "sink", the former corresponding with the boiler and the latter with the condenser of an engine. Thus, (p_1, v_1, T_1) apply to the meteorological conditions in the warm air over the ocean before the anticyclone disturbs it, and (p_0, v_0, T_0) to the conditions prevailing in the cool air of the anticyclone itself. The motions of the atmosphere, which result in clouds, thunderstorms, and waterspouts simply represent the stream lines through which the air flows in restoring the abnormal temperatures to equilibrium. In nature there is a tendency to produce a succession of such thermal engines throughout the atmosphere, first on a large scale due to solar radiation, with the boiler along the Tropics, and the condenser around the poles; second on a small scale, wherever in the local circulations, which are secondaries derived from the first kind, masses of air of different temperatures come into close juxtaposition. Similar processes continue from step to step, from the general circulation on the entire hemisphere of the earth, to the smallest whirl that occurs in the turbulent internal vortex motions of the air.

Were it possible to trace the course of these stream lines throughout such congested masses as are in motion in tornadoes and thunderstorms, we should be able to study many interesting problems in hydrodynamics as well as in thermodynamics.

Examining the meteorological data I make the following deductions. *The temperature at the base of the waterspout was about 67.5°.* This is the maximum temperature of the day, and the thermograph for Nantucket shows that the waterspout occurred at the time of maximum temperature, just before the break in weather occurred. It then fell to about 56.5° at Vineyard Haven, and 59.0° at Woods Hole and Nantucket, so *that the effective temperature in the anticyclone was about 58.0°.* Hence we shall assume $t_1 = 67.5°$ F. and $t_0 = 58.0°$ F. *The pressure in the anticyclone may be taken 30.10, and on the ocean near the waterspout 30.05, which is only a little lower.* The table makes the relative humidity range above 90 per cent at Nantucket for several days till August 18. By the morning of August 19 a decided change had occurred, in which the relative humidity fell nearly to 60 per cent. At Nantucket it was 60 per cent at 8:20 a. m., and 74 per cent at 8:20 p. m.; at Woods Hole it was 61 per cent at 8:17 p. m. It is very remarkable that this great waterspout was *produced on the day when the lower strata of the atmosphere were drier than on any other*

(A) TABLE 50.—*Meteorological data for August 19, 1896.*

Station.	Pressure.	Temperature and moisture.							Wind.		Precipitation. Amt.	Clouds.			Local time of observation.
	B_0	t.	t_1.	d.	R. H.	e.	Max. t.	Min. t.	Dir.	Vel.		Amt.	Kind.	Dir.	
	Inches.	° *F.*	° *F.*	° *F.*	*Per cent.*	*Inches.*	° *F.*	° *F.*		*Miles p. h.*	*Inch.*				
Woods Hole	30.15	64.0	56.2	50.0	61	.360	64.0 67.4	59.0 64.0	nw.	14	0.33	0	0	0	8:17 a. m. 8:17 p. m.
Vineyard Haven							72.0	56.5	nw.		0.38				8:17 p. m.
Nantucket	30.03 30.13	64.0 62.0	56.5 57.0	51.0 53.0	62 74	.373 .402	64.0 67.5	59.2 61.5	n. n.	10 8	0.02 0.03	few 0	Ci. 0	w. 0	8:20 a. m. 8:20 p. m.

(B) *Records for 10 days either side of August 19, 1896.*

Dates.	Woods Hole, 8:17 p. m.							Nantucket, 8:20 p. m.						
	t.	t_1.	d.	R. H.	e.	Max. t.	Min. t.	t.	t_1.	d.	R. H.	e.	Max. t.	Min. t.
	° *F.*	° *F.*	° *F.*	*Per cent.*	*Inches.*	° *F.*	° *F.*	° *F.*	° *F.*	° *F.*	*Per cent.*	*Inches.*	° *F.*	° *F.*
August 9	73.0	71.8	72	94	.783	78.2	72.2	70.0	70.5	71	98	.757	78.0	70.2
August 10	76.0	71.5	69	80	.707	85.8	73.0	72.5	71.0	70	93	.732	86.3	72.5
August 11	76.7	72.5	70	82	.732	87.0	75.0	74.5	72.5	72	91	.783	83.2	74.5
August 12	75.2	73.0	72	90	.783	85.1	75.2	71.0	70.0	70	95	.732	81.8	71.0
August 13	72.5	71.5	71	95	.757	81.9	72.5	71.0	70.0	70	95	.732	82.0	71.0
August 14	66.5	66.0	66	98	.638	71.0	66.5	66.0	66.0	66	100	.638	74.0	66.0
August 15	65.2	64.0	63	94	.575	69.0	65.0	64.0	63.5	63	97	.575	67.5	64.0
August 16	69.2	67.0	66	89	.638	71.0	65.9	65.0	64.5	64	97	.595	66.8	63.2
August 17	68.8	63.8	61	76	.536	77.7	68.5	66.5	64.5	64	90	.595	74.2	66.5
August 18	62.2	58.2	55	79	.432	69.8	60.3	64.0	63.5	63	97	.575	73 0	64.0
August 19	64.0	56.2	50	61	.360	67.4	64.0	62.0	57.0	53	74	.402	67.5	61.5
August 20	64.8	59.0	55	71	.432	70.0	59.1	59.5	55.5	52	78	.387	69.0	59.0
August 21	65.0	58.3	54	67	.417	71.0	64.5	57.5	56.5	56	94	.448	68.5	57.5
August 22	67.0	61.0	57	71	.465	71.8	65.9	64.5	60.0	57	77	.465	71.0	64.5
August 23	71.0	70.2	70	96	.732	73.3	68.2	69.0	68.0	68	95	.684	74.6	66.1
August 24	71.5	69.0	68	88	.684	76.1	69.5	67.5	65.5	64	90	.595	75.5	67.5
August 25	65.0	62.8	62	89	.555	75.7	64.0	64.5	64.0	64	97	.595	74.8	64.0
August 26	68.0	65.0	63	85	.575	73.2	66.3	64.0	62.5	62	92	.555	73.8	63.5
August 27	68.0	65.0	63	85	.375	73.8	67.0	68.5	67.0	66	93	.638	74.0	63.3
August 28	65.3	58.8	54	68	.417	70.7	60.8	61.5	56.5	52	74	.387	68.0	61.5
August 29	64.0	58.0	54	70	.417	68.0	62.9	58.0	56.0	55	89	.432	68.8	58.0

(C) *Continuous self-register of pressure and temperature at Nantucket, Mass., August 19, 1896.*

Hours of seventy-fifth meridian time.	Mid't.	2 a. m.	4 a. m.	6 a. m.	8 a. m.	10 a. m.	Noon.	2 p. m.	4 p. m.	6 p. m.	8 p. m.	10 p. m.	Mid't.
Pressure, in inches	29.99	29.97	29.96	30.00	30.03	30.05	30.05	30.05	30.07	30.09	30.12	30.15	30.16
Temperature, degrees Fahrenheit	61.0	60.0	61.0	62.5	64.0	65.0	66.0	67.0	63.0	64.0	63.0	63.5	63.0

day of that month. A comparatively low humidity was prevailing during the formation of the vortex, and even the thunderstorms of the afternoon did not avail to increase it much, as it rose only to 74 per cent in the evening. There was no doubt considerable local fluctuation in the humidity for short intervals, but the prevailing anticyclone lowered the humidity for the duration of two or three days. We have therefore the special problem of accounting for the waterspout during conditions which were quite the reverse of those usually assumed to prevail. Tornadoes are usually found connected with warm, moist air, but here we find cool, dry air, showing that it is not high surface temperature and humidity alone that causes these vortices. After several trial computations on the cloud dimensions, which depend upon the correct surface data, and allowing a small rise in the humidity percentage from 8:17 a. m. to 1 p. m. over the 61 or 62 per cent prevailing at the early hour, I have concluded to accept R. H.=64 per cent as that prevailing near the surface of the water at the time the waterspout was formed. We therefore have to begin the computations with the following data for the air just above the surface of the water at 1 p. m.:

$$B = 30.05 \text{ inches.}$$
$$t = 67.5° \text{ F.}$$
$$\text{R. H.} = 64 \text{ per cent.}$$

COMPUTATION OF THE PRESSURE B, TEMPERATURE t, VAPOR-TENSION e, AND HEIGHT H, FOR THE α, β, γ, δ STAGES.

We now have the meteorological data at sea level beneath the cloud which surmounted the waterspout, as shown in the photograph (fig. 29, 2d C), taken at about 1:08 p. m., by Mr. E. K. Hallet. This cloud is a large cumulo-nimbus; its flat base is about 3500 feet above the sea level, and its apex about three miles high. Upon the southern extension, on the right-hand side of the plate, there is a thunderstorm and the rain is falling freely; the northern side is clearing, and there seems to be sunshine in several places; from the midst of the cloud the waterspout projects down to the sea level. At the top of the waterspout tube the curvature of the vortex is well defined, and at the bottom there is a fountain of water surrounding it in a circular cascade. We shall determine as accurately as possible the meteorological elements (B, t, e) at the base of the cloud, that is, at the top of the α-stage, which extends from the sea level to the lower face of the cloud, and expresses the fact that this stratum of air is composed of dry air and invisible aqueous vapor mixed in certain proportions, as indicated by the relative humidity, which is 64 per cent at sea level and 100 per cent at the base of the cloud. We shall use the notation:

h_1, B_1, t_1, e_1 at the top of the α-stage, or the base of the cloud.
h, B, t, e at the bottom of the α-stage, or the sea level.

Compare the notation on page 677 of the International Cloud Report.

(1) The working formula for the α-stage is No. 145, as given on page 496 of the same cloud report:

$$C_\alpha = \text{Constant} = \left(0.2374 + 0.1512\,\frac{e}{B} + 0.0232\,\frac{e^2}{B^2}\right)\log T. \quad \text{I}_\alpha$$

$$(145) \qquad - \left(0.06858 + 0.02592\,\frac{e}{B}\right)\log B \ldots\ldots\ldots \text{II}_\alpha$$

where T is the absolute temperature = 273° + t° centigrade. This formula is reduced to the numerical Tables 94, 95, 96, pages 550 to 553 of that report, inclusive, the T and B terms being summarized by $C_\alpha = \text{I}_\alpha + \text{II}_\alpha$. Some examples of the use of these tables are given in that report on page 573 and following, also page 765 and following, the accompanying text having the necessary precepts for practical work. They will be further illustrated in the examples offered by this waterspout.

(2) The β-stage extends from the base of a cloud to the plane of freezing temperature, $t = 0$°C., which in this cumulus cloud lies at about 2800 meters, or 9200 feet, above sea level, so that the β-stage stratum is not far from 1700 meters or 5600 feet thick. In the present case the α-stage is about two-thirds of a mile deep, and the β-stage a little more than one mile deep. The β-stage consists of a mixture of dry air, invisible aqueous vapor, and condensed aqueous vapor in the form of minute water drops or cloud particles which reflect and refract the light, and thus make the cloud appear as a visible mass or a region of condensation. The formula for the β-stage is No. 146 as given on page 496:

$$C_\beta = \text{Constant} = \left(0.2374 + 0.4743\,\frac{e}{B} + 0.145\,\frac{e^2}{B^2}\right)\log T_1 \ldots \text{I}_\beta$$

$$(146) \qquad - \left(0.06858 - 0.04266\,\frac{e}{B}\right)\log (B_1 - e_1) \ldots \text{II}_\beta$$

$$+ \left[\frac{497.5}{T_1} - 0.4404 - \left(\frac{309.4}{T_1} - 0.2739\right)\frac{e}{B}\right]\frac{e_1}{B_1 - e_1} \ldots \text{III}_\beta,$$

where the notation is taken from Table 133, page 677, of the Cloud Report. The numerical tables are given on pages 554 to 556 and Tables 97, 98, and 99 for the successive terms, I_β, II_β, III_β, and examples of the computation may be found on pages 574, 696 and following, also in this paper.

(3) The γ-stage stratum is shallow, in this case only 75 meters or 246 feet thick, and it contains the layer of atmosphere within which the water of the cloud is turning to ice, the temperature remaining constant at the freezing point during this process. In this layer the aqueous content is changing its physical state, though not its temperature, and there is only a mixture of aqueous vapor, water, and ice, since there is no thermal change in the dry air because of the constant temperature, the cooling by expansion just balancing the warming due to evolution of latent heat.

This is a very interesting process and will be referred to again in a later section of this paper. The formula is No. 147, on page 496, in the notation of the Cloud Report, page 677:

$$C_\gamma = \text{Constant} = -\left(0.06858 - 0.04266\,\frac{e}{B}\right)\log (B_0 - e_0) \ldots\ldots \text{II}_\gamma$$

$$(147) \quad + \left[\frac{547.2}{T_0} - 0.4404 - \left(\frac{340.4}{T_0} - 0.2739\right)\frac{e}{B}\right]\frac{e_0}{B_0 - e_0} \ldots \text{III}_\gamma$$

$$- \left(49.78\,\frac{e}{B} + 18.82\,\frac{e^2}{B^2}\right)\frac{1}{T_0} \ldots\ldots\ldots\ldots, \quad \text{IV}_\gamma$$

The table for II_γ is the same as II_β, page 555, and those for III_γ and IV_γ are given on page 557. Numerical examples can be found on page 575, also on page 697 and following; likewise compare the γ-stage of the Cottage City waterspout, later in this paper, under (c).

(4) The δ-stage relates to a stratum of mixed dry air, frozen aqueous vapor, i. e., ice vapor, and ice or snow below the freezing temperature, and in the present case this stratum extends from the height of about 2880 meters, or 9450 feet, above the sea level to the apex of the cloud which is not far from 4940 meters, or 16,200 feet; so that the δ-stage, or the snow-stage, is about 2060 meters, or 6750 feet in depth, that is about one and one-fourth miles thick. The formula is No. 148 on page 496, in notation of pages 677 or 678, as follows:

$$C_\delta = \text{Constant} = \left(0.2374 + 0.4743\,\frac{e}{B} + 0.145\,\frac{e^2}{B^2}\right)\log T_{11} \ldots \quad \text{I}_\delta$$

$$(148) \qquad - \left(0.06858 - 0.04266\,\frac{e}{B}\right)\log (B_{11} - e_{11}) \ldots\ldots \text{II}_\delta$$

$$+ \left[\frac{547.2}{T_{11}} - 0.4404 - \left(\frac{340.4}{T_{11}} - 0.2739\right)\frac{e}{B}\right]\frac{e_{11}}{B_{11} - e_{11}} \ldots \text{III}_\delta$$

The numerical tables are on pages 555, 558, and 559, the table for II_δ being identical with that for II_β. Examples of the frozen or δ-stage may be found on pages 576, 697–712, also in the following computations on this waterspout. It is convenient to have a distinct notation for the bottom and top of each of these four stages, and this is done in the notation of pages 677 and 678 of the Cloud Report by simply transferring the suffix of the bottom of the stage to the place of an exponent at the top of that stage. The notation for the top of one stage is equivalent to that of the bottom of the next higher stage, and both symbols may be employed.

In the computation of h, B, t, e for the several stages of the Cottage City waterspout explicit directions will now be given for each stage in the work, for the sake of providing suitable precepts to be followed by others pursuing this line of research, and in order that the several steps may be clearly and accurately understood. The tables for each stage, pages 550 to 559, were all computed so that the absolute temperature, $T = 273° + t$°C., which appears in the formulæ is found as t° C. in the argument of the tables, for the sake of convenience in computing.

(A) THE α-STAGE OR UNSATURATED PROCESS.

The sea-level conditions as above given may be converted into the metric system by the following table:

	English system.	Transferred to the metric system.	Metric system.
B	30.05 in.	By Smithsonian Table 64 ...	763.27 mm.
t	67.5° F.	By Smithsonian Table 2	19.72° C.
Relative humidity	64 per ct.	.....	64 per cent.
e	.....	By Smithsonian Table 43, e for saturation at 19.72°, Broch's value, is 17.06 mm. and 64 per cent of this is—	10.92 mm.
$\frac{e}{B}$	.....	10.92 ÷ 763.27 = ...	0.0143
Reduction of $\frac{e}{B}$	.....	From Table 136 p. 690, Cloud Report.	—0.0013
Corrected $\frac{e}{B}$	.....	0.0143 — 0.0013 = ...	0.0130

The result of the discussion of the value of the ratio $\frac{e}{B}$ at the sea level and at the base of the cumulus cloud, as given on pages 677 to 693 of the Cloud Report, was to show that the ratio $\frac{e}{B}$ at the sea level in the α-stage has a larger value than at the base of the cloud. This is due to the fact that in nature the atmospheric process does not exactly follow the adopted theory of the α-stage, and is not a true adiabatic process as the formula requires. We can, however, adapt the formula to this case by applying to the sea-level value of $\frac{e}{B}$ a slight correction to make it smaller at the base of the cloud, and, as the outcome of a very extensive discussion of this problem, the necessary corrections are given in Table 136,

page 690, of the Cloud Report for metric measures, and on Table 18, page 107, of the Barometry Report for English measures. It is necessary to determine this ratio quite accurately for close computations of the humidity correction, according to the theory adopted in these two reports. In this connection the reader is referred to further remarks on this formula, which has been in use since 1897 by the Weather Bureau, as found on page 781 of Dr. J. Hann's Lehrbuch der Meteorologie, 1901, and on page 30 of the Meteorologische Zeitschrift of January, 1903, by Dr. J. Liznar, where the formulæ are proved to be sufficiently accurate for all practical computations. The Table 136 gives for the argument $\frac{e}{B} = .0143$ and the assumed approximate height of the base of the cloud, 1100 meters, a correction which I take as $-.0013$, so that we have $.0143 - .0013 = .0130$ as the value of $\frac{e}{B}$ to be employed throughout the computation, at least so long as precipitation does not produce pseudo-adiabatic conditions. While there is rain falling from the cloud at some distance to the south, where the approximate adiabatic process has been disturbed, it yet seems proper to retain the full ratio $\frac{e}{B} = 0.0130$ for computing along the line from the waterspout to the apex of the cloud, since it is probable that the activity of the cloud continues still to be nearly adiabatic along the main line of ascension of the vapor of condensation. It is to be particularly noted that this ratio, $\frac{e}{B} = 0.0130$, is to be used in computing every stage, and is the quantity that controls the value of the pressure, temperature, and vapor tension at all the levels of the cloud. The fact that the heights computed by the thermodynamic processes are found to be in close agreement with those measured on the photograph, according to the data of the survey, also tends to justify the adoption of that value of the ratio $\frac{e}{B}$.

The constant C_a in the a-stage is computed as follows:

I_a	1.3596	Table 95, arguments $\left(t = 19.72, \frac{e}{B} = 0.0130\right)$.
II_a	$-$ .4574	Table 96, arguments $\left(B = 763.3, \frac{e}{B} = 0.0130\right)$.
C_a	0.9022	Sum of I_a and II_a = constant.

These values should be determined with accuracy to the fourth decimal place throughout the computation, and the result will then be sufficiently exact to follow the natural processes exactly as they develop. The significance of the constant $C_a = 0.9022$ can be understood from this consideration. We have a set of mutually related thermodynamic quantities, $B = 763.3$, $t = 19.72°$, $e = 10.92$, $\frac{e}{B} = 0.0130$, connected together in such a way as to give the constant 0.9022.

There are many other sets of values of B, t, e, which can be developed by changing the thermodynamic system adiabatically, that is to say without adding or subtracting any heat. Now, as a given mass of the aqueous vapor, so many grams per thousand grams of air, or so many thousandths of one kilogram, rises from the sea level and ascends upward to the base of the cloud, it evidently passes through pressures and temperatures which are each diminishing in amount. Then at a certain height, where the pressure and temperature are sufficiently reduced, this same mass of vapor will begin to saturate the kilogram, and condense as visible vapor. In all the steps of change in B, t, e from the surface to the cloud-base, the same constant $C_a = 0.9022$ must be retained, and also the same ratio $\frac{e}{B}$ must be kept, so that there remain the two variables B and t. Now the connection between t and e is fixed at a certain value by the saturation tables, so that if t_1 *is assumed*, e_1 is found by the table, and B_1 is obtained by computing backwards through Tables 95, 96, the result being checked by having the ratio $\frac{e_1}{B_1} = 0.0130$. This usually requires a few trials to effect correctly, and one needs a little practise with the data to do it expeditiously. In order to make a beginning with the trial temperatures it is well to remember that in dealing with cumulus clouds the average fall in temperature in passing from the sea level to the base of the cloud, through 1100 meters, is usually 10° to 11° C. This is shown in Table 147, where for the surface temperature $t = 20°$, and $\frac{e}{B} = 0.0143$, which is the original value of $\frac{e}{B_1}$, we have for the temperature gradient per 1000 meters, $Gt = -9.50$. This table is adapted for the cumulus cloud-base at the height of 1000 to 1100 meters as it stands, without modification. If the temperature is for any other height, the gradient must be modified somewhat as indicated by the subtable on page 727, though the gradients may become very abnormal under certain conditions. It is proper from these considerations to begin the trial values of t_1, the temperature at the base of the cloud, with $t_1 = 9°$, and $t_1 = 10°$. These values will give resulting values of the $\frac{e_1}{B_1}$ which will enable us by interpolation to find the correct value of t_1 at the third trial.

The following form illustrates the method of procedure for assumed successive values of t_1. The last column gives the arguments, or the method of obtaining the figures in the second and third columns:

t_1	9°	10°	(Assumed.)
e_1	8.55	9.14	Smithsonian Table 43.
I_a	1.3507	1.3515	Table 95, arguments. $t = 9°$, $\frac{e}{B} = 0.0130$; $t = 10°$, $\frac{e}{B} = 0.0130$
C_a	.9022	.9022	From preceding result, formula 145.
II_a	$-$ .4485	$-$ .4493	$C_a - I_a = II_a$.
B_1	670	678	Table 96, argument. $\frac{e}{B} = 0.0130$.
$\frac{e_1}{B_1}$	0.0128	0.0135	Resulting ratio of $\frac{e_1}{B_1}$.

This ratio should have come out $\frac{e_1}{B_1} = 0.0130$ if the trial values of t_1 had been correct, and interpolation shows that in order to make it so the value of t_1 should be 9.3°.

Repeat the computation,

t_1	9.3°	
e_1	8.72	Smithsonian Table 43.
I_a	1.3509	Cloud Report Table 95.
C_a	.9022	As above.
II_a	$-$ .4487	
B_1	672	Cloud Report Table 96.
$\frac{e_1}{B_1}$	0.0130.	This completes the check, and gives $B_1 = 672$, $t_1 = 9.3°$, $e_1 = 8.72$ at the base of the cloud.

We next compute the height at which the visible cloud base floats above the sea level.

For Table 91 we have the formula of barometric reductions and the corresponding height,

$$\log B_0 - \log B_1 = +m - \beta m - \gamma m.$$

	Logarithm.
B_0 763.27	2.88268
B_1 672	2.82737
$m-\beta m-\gamma m$	.05531

Since Table 91 is constructed to find m through the arguments, height $= H$ and mean temperature $T_m = \theta$, in order to obtain H by the inverse process we must compute m itself from $m-\beta m-\gamma m=.05531$, by taking $m=.05531+\beta m+\gamma m$.

By Table 92, with the arguments ($B_0=763$ and $e_0=10.9$) we have:

For argument I$=.378\frac{e_0}{B_0}=$ ..... .0054 and

For argument II$=\beta$ (for assumed $H=1100$) .0048

So that $+\beta m$ (for $m=.055$) ..... +0.00026

By Table 93, $+\gamma m$ (for $\varphi=41.5°$) ..... +0.00001

Hence, since $\log B_0 - \log B_1 =$ 0.05531

We have, m 0.05558

Finally the temperature $\theta=\frac{1}{2}(19.7+9.3)=14.5°$.

By Table 91, with the arguments ($\theta=14.5$ and $m=0.05558$) we find by interpolating $H_a = \begin{cases} 1078 \text{ meters.} \\ 3537 \text{ feet.} \end{cases}$

We thus find, from the thermodynamic computation, that the height from the sea level to the plane of condensation at the base of the cloud is **3537 feet**. From the measurements on fig. 27, 2d A, as contained on page 311, the approximate height is 60 mm. or **3600 feet**. Considering the uncertainty in determining the exact plane which is the base of the cloud sheet, where the vortex motion becomes asymptotic, it is evident that we have reached a satisfactory agreement regarding the height by two independent methods. Furthermore, this check is a good evidence that the fundamental data in these computations are in harmony geometrically and thermodynamically, and we may, therefore, feel confident that the other deductions depending upon them are substantially correct.

The gradients per 100 meters for the a-stage are now easily obtained.

mm.		°C.			
B_0 763.3	t_0	19.7	e_0	10.92	whence $H_a =$
B_1 672.0	t_1	9.3	e_1	8.72	1078 meters.
B_1-B_0 −91.3	t_1-t_0	−10.4	e_1-e_0	−2.20	

Divide B_1-B_0 etc. by 10.78, or the height in units of 100 meters.

$(G.\ B)_O$ −8.46 $(G.t)_O$ −0.963 $(G.e)_O$ −0.204 . . By observation.

$(G.\ B)_C$ −8.40 $(G.t)_C$ −0.950 $(G.e)_C$ −0.192 . . Table 147, I, II, III Cloud Report.

The tabular gradients are found in Table 147, page 724, which gives the gradients that prevail for average conditions, by using the arguments $\left(t_0 = 19.7 \text{ and } \frac{e}{B} = 0.0145\right)$. The agreement is such as to show that the meteorological conditions forming the waterspout cloud are entirely in harmony with those which are found to prevail under similar circumstances, when thunderstorms and tornadoes are in action. If, however, we compare them with the gradients found under the normal August conditions as given in the Barometry Report for Nantucket, we have the following data taken from page 707:

Inch.		°F.		Inch.	
B_m 29.977	t_0	67.7	e_0	.571	English
B_1 26.470	t_1	60.4	e_1	.445	measures.

Convert these into metric measures.

mm.		°C.		mm.	
B_m 761.35	t_0	19.83	e_0	14.50	Metric
B_1 672.34	t_1	15.78	e_1	11.30	measures.
B_1-B_m −89.01	t_1-t_0	−4.05	e_1-e_0	−3.20	

Divide B_1-B_m etc. by 10.78, or the height in units of 100 meters.

$(G.\ B)_B$ −8.24 $(G.t)_B$ −0.375 $(G.e)_B$ −0.296

The discussion of these gradients will be resumed, as they are important in the theory of atmospheric vortices.

(B) THE β-STAGE, OR SATURATED PROCESS.

The computation of the numerical value of the meterological elements (B^1, t^1, e^1) at the top of the β-stage, or the bottom of the γ-stage (B_0, t_0, e_0), proceeds as follows:

t_1	9.3° C.	Taken from the top of the a-stage.
B_1	672 mm.	
e_1	8.72 mm.	
$\frac{e}{B}$	0.0130	The same as adopted for the a-stage.
B_1-e_1	663.28	
$\frac{e_1}{B_1-e_1}$	0.0132	

		Arguments.
I_β	+1.3747	Table 97 $\left(t=9.3°, \frac{e}{B}=.0130\right)$.
II_β	− .4419	Table 98 $\left(B_1-e_1=663.3, \frac{e}{B}=.0130\right)$.
III_β	+ .0173	Table 99 $\left(t=9.3°, \frac{e_1}{B_1-e_1}=.0132\right)$.
C_β	0.9501	Constant for the β-stage.

At the top of the β-stage two quantities are fixed, namely, temperature $t^1=0°$ and $e^1=4.57$ mm., so that the term I_β can be at once found and subtracted from the constant.

t^1	0°	
e^1	4.57 mm.	
I_β	1.3664	Table 97, arguments $\left(t=0°, \frac{e}{B}=.0130\right)$.
C_β	0.9501	C_β taken from above.
	−0.4163	Subtract I_β from C_β.

The term −0.4163 is made up of II_β and III_β at the top of the β-stage, and these depend upon finding by trials B^1, the pressure there prevailing. It is convenient to employ Hertz' well-known diagram of adiabatic changes in the $a\ \beta\ \gamma\ \delta$ stages, a copy of which is given in Professor Abbe's Translations, The Mechanics of the Earth's Atmosphere, page 202, in order to have approximate values to figure the trial computations. Enter the β-stage at the point $B_1=672$, $t_1=9.3°$, and follow the system of β lines up to $t=0°$ and $B=552$. Make two trials by two assumptions of the pressure B^1.

B^1	552.0	542.0	Assumed values of B^1
e^1	4.57	4.57	
B^1-e^1	547.4	537.4	
$\frac{e^1}{B^1-e^1}$	.0084	.0085	
II_β	−.4289	−.4276	Table 98, arguments $\begin{cases} B^1-e^1=547.4, \frac{e}{B}=.0130 \\ \text{“} \quad 537.4, \quad \text{“} \end{cases}$
III_β	+.0115	+.0116	Table 99, arguments $\begin{cases} t=0, \frac{e^1}{B^1-e^1}=.0084 \\ \text{“} \quad \text{“} \quad =.0085 \end{cases}$
II+III	−.4174	−.4160	

The term II+III should be equal to −.4163, and hence we interpolate another assumed value of $B^1=544$. Repeat the trial,

B^1	544	Assumed by interpolation.
B^1-e^1	539.4	
$\frac{e^1}{B^1-e^1}$	.0085	

Arguments.

II_β	−.4279	Table 98,	$\left(B^1-e^1=539.4, \frac{e}{B}=.0130\right)$
III_β	+.0116	Table 99,	$\left(t=0, \frac{e^1}{B^1-e^1}=.0085\right)$
II+III	−.4163	The check is complete for $B^1=544$.	

The computation for H_β, the depth of the β-stage, is as follows:

		Logarithms.			
B_1	672	2.82737	$e_1=8.72$	$t_1=9.3°$	$\theta=4.7°$
B^1	544	2.73560	$e^1=4.57$	$t^1=0.$	
$m-\beta m-\gamma m$		0.09177			

Arguments.

βm	+	38	Table 92	I = .0050, II = .0041
γm	+	1	Table 93	$e_1=8.7$, $H=1700$, $B_1=672$, $m=.092$
m		0.09216		

H_β = { 1728 meters. Table 91, arguments ($\theta=4.7°$, $m=.09216$). / 5669 feet.

The gradients for the β-stage are now found,

mm.		°C.	mm.	
B^1 544	t^1	0	$e^1=4.57$	H_β = 1728 meters.
B_1 672	t_1	9.3	$e_1=8.72$	
B^1-B_1-128	$t^1-t_1-9.3$		$e^1-e_1-4.15$	

Divide B^1-B_1 etc. by 17.28, or the height in units of 100 meters.

$(G.B_1)_O-7.40$	$(G.t_1)_O-.538$	$(G.e_1)_O-.240$	By observation.
$(G.B_1)_C-7.40$	$(G.t_1)_C-.540$	$(G.e_1)_C-.260$	Table 147, IV, for $\frac{e_1}{B_1}=.0130$.

In order to compare this with the normal conditions of the atmosphere in August, we again take the Nantucket data, Barometry Report, page 707, where (B, t, e) are given on the 3500-foot plane and the 10000-foot plane.

The depth of the α-stage = H_α = 1078 meters = 3537 feet.
The depth of the β-stage = H_β = 1728 meters = 5669 feet.
Height of top of β-stage above sea level ..... H^1 2806 meters = 9206 feet.

By interpolation to the given heights, 1078 meters=3537 feet and 2806 meters=9206 feet, we obtain in metric measures, from page 707 of the Barometry Report, the data.

mm.		°C.	mm.
B^1 548.6	t^1	9.22	e^1 4.95
B_1 671.6	t_1	15.72	e_1 11.25
$B^1-B_1-123.0$	$t^1-t_1-6.50$		$e^1-e_1-6.30$

Divide by 17.28, the height of the β-stage in units of 100 meters.

$(G.B_1)_B-7.11$ $(G.t_1)_B-.376$ $(G.e_1)_B-.364$

These sets of gradients for the β-stage will also require further discussion.

(c) THE γ-STAGE, OR FREEZING PROCESS.

In the freezing stage there is no change in the temperature, which is $t_0=0°$, nor in the vapor tension, which is $e_0=4.57$ mm., and we have only to compute the variation in the pressure B_0.

Constant $II_\beta + III_\beta$	−.4163	brought from the β-stage.
t_0	0°	
B_0	544.	
e_0	4.57	
e	0.0130	
B		

Assume B^0	539.	for the top of the γ-stage.
e^0	4.57	
B^0-e^0	534.4	
$\frac{e^0}{B^0-e^0}$	.0086	

Arguments.

II_γ	−.4273	Table 98	$\left(B^0-e^0=534.4, \frac{e}{B}=0.0130\right)$.
III_γ	+.0134	Table 100	$\left(t=0, \frac{e^0}{B^0-e^0}=.0086\right)$.
IV_γ	−.0024	Table 100	$\left(t=0, \frac{e}{B}=0.0130\right)$.
Sum	−.4163	This satisfies the check.	

For the depth of the γ-stage we compute,

		Logarithms.
B_0	544.	2.73560
B^0	539.	2.73159
$m-\beta m-\gamma m$	.00401	The corrections for $-\beta m-\gamma m$ can be neglected.

H_γ = ... { 74 meters. Table 91, argument ($\theta=0°$, $m=.00401$) / 243 feet.

The pressure gradient in the γ-stage is,

$(G.B_0)_O=6.76$ By observation.
$(G.B_0)_C=6.70$ Table 147, V, of the Cloud Report.

(D) THE δ-STAGE, OR FROZEN PROCESS.

The δ-stage extends to the visible tops of the clouds, and we may, therefore, take such a temperature as will, through the intermediate computation, produce a height which agrees with the height measured on the photograph. A preliminary trial of −11°C. for the temperature gives a height that is somewhat lower than the apex of the cloud, and a second trial of −12°C. seemed to be about right, so that it has been adopted for the numerical example.

For the constant in the δ-stage, we have,

t_{II}	0°C.	brought from the top of the γ-stage.
B_{II}	539.	
e_{II}	4.57	
$B_{II}-e_{II}$	534.4	
$\frac{e_{II}}{B_{II}-e_{II}}$	.0086	
$\frac{e}{B}$	.0130	

Arguments.

I_δ	1.3664	Table 101,	$\left(t=0, \frac{e}{B}=.0130\right)$.
II_δ	−.4273	Table 98,	$\left(B_{II}-e_{II}=534.4, \frac{e}{B}=.0130\right)$.
III_δ	+.0134	Table 102,	$\left(t=0, \frac{e_{II}}{B_{II}-e_{II}}=.0086\right)$.
δ-Constant	.9525		

Assume t^{II}	−12° C.	Argument.	
e^{II}	1.64 mm.	Table 103,	$t=-12°$C.
I_δ	1.3556	Table 101,	$\left(t=-12, \frac{e}{B}=.0130\right)$.
Constant	.9525		
$II_\delta+III_\delta$	−.4031	This is the constant to determine B^{II}.	

Assume B^{II}	415.0	419.0
e^{II}	1.6	1.6
$B^{II}-e^{II}$	413.4	417.4

$\frac{e''}{B''-e''}$	.0040	.0040	
II_δ	−.4098	−.4105	Table 98, argument. $\left(B''-e'', \frac{e}{B}=.0130\right)$.
III_δ	+.0066	.0066	Table 102, arguments. $\left(t=-12°, \frac{e''}{B''-e''}=.0040\right)$.
	−.4032	−.4039	

Interpolation indicates $B''=414.5$.

Assume B''	414.5		
e''	1.64		
$B''-e''$	412.9		
$\frac{e''}{B''-e''}$	.0040		
			Arguments.
II_δ	− .4097	Table 98	$\left(B''-e''=412.9, \frac{e}{B}=.0130\right)$.
III_δ	+ .0066	Table 102	$\left(t=-12°, \frac{e''}{B''-e''}=.0040\right)$.
	− .4031	This checks the constant for the pressure $B''=414.5$ mm.	

The depth of the δ-stage is found as follows:

		Logarithms.	
B_{11}	539.0	2.73159	
B''	414.5	2.61752	
			Arguments.
$m-\beta m-\gamma m$	.11407		I = .0033 (e=4.57, B=539).
$+\beta m+\gamma m$	.00029		II = .0026 (assume H=2000).
			βm = .0026 × .114 = .00029.
m	.11436		

$$\theta=\frac{0-12°}{2}=-6°$$

		Arguments.
H_δ = ...	2062 meters.	Table 91 (θ= −6°, m=.11436).
	6765 feet	

The gradients in the δ-stage are now found:

	mm.		°C.		mm.	
B''	414.5	t''	−12.0	e''	1.64	H_δ = 2062 m.
B_{11}	539.0	t_{11}	00.0	e_{11}	4.57	
$B''-B_{11}$	−124.5	$t''-t_{11}$	−12.0	$e''-e_{11}$	−2.93	

Divide $B''-B_{11}$ etc. by 20.62, or the height in units of 100 meters.

$(G.\ B_{11})_o$	− 6.04	$(G.\ t_{11})_o$ −.582	$(G.\ e_{11})_o$ −.142 By observation.
$(G.\ B_{11})_c$	− 6.50	$(G.\ t_{11})_c$ −.550	$(G.\ e_{11})_c$ −.140 Table 147; VI, VII, Cloud Report.

The top of the cloud is about 5000 meters above sea level, so that in Section VII, Table 147, for H=5000 and $\frac{e_1}{B_1}$ =. 0130, we find the vapor tension gradient $(G.\ e_{11})_c$ = −0.140 per 100 meters.

Table 51, summary of the data for the Cottage City waterspout, August 19, 1896, contains the results of the preceding computations on the thermodynamic conditions prevailing at that time, in both the metric and the English systems of measures. The first column of figures under each system gives the vertical distances H, measured in millimeters and inches on Hallet's photograph, 2d C, taken at about 1:08 p. m.; the second, the corresponding height in meters and feet; the third, the pressure in millimeters and inches; the fourth, the temperature in degrees centigrade and Fahrenheit; the fifth, the vapor tension in millimeters and inches; the last column the gradients as extracted from the Cloud Report from the same data; also the gradients as deduced from the Barometry Report for the same season of the year. By inspection, it is noted:

(1) In the a-stage in the English measures, the pressure gradient has increased from −0.098 to −0.101 per 100 feet. The normal gradient for August at Nantucket, only a few miles from the scene of the waterspout, is −0.098 per 100 feet, making a pressure fall of −3.47 inches from the sea level to the base of the cloud, or a change of pressure from 30.05 inches to 26.58 inches; the waterspout gradient −0.101 per 100 feet gives a fall of −3.58 inches and a pressure of 26.47 inches at the height 3537 feet, the base of the cloud. There is thus a total change in the vertical gradient of 0.11 inch from the sea level to the cloud, and it is this increased difference of pressure which causes the air to rise generally from the surface of the sea to the cloud, and is intimately concerned with the generation of the vortex tube. We may remark in passing that one of our purposes in constructing tables and charts of the normal values of the pressure, temperature, and vapor tension on the 3500-foot and the 10,000-foot planes, in connection with their values on the sea-level planes, was to afford the data for establishing the *normal vertical gradients* in the lower strata of the atmosphere, which shall represent the average stratification when undisturbed by convectional action. It is very desirable that these gradients should be checked by numerous direct observations of B, t, e, taken day and night, winter and summer, so that the normal gradients can be separated from the convectional gradients in a perfectly reliable manner. As this must be the work of years for the United States, it is permissible to employ the gradients contained in the Barometry Report, which rest upon the best data we now possess, in such discussions as are suggested by the Cottage City waterspout. Similarly, the phenomena of tornadoes in the Mississippi Valley, of thunderstorms generally, of cyclones, anticyclones, and hurricanes can be properly studied only by comparing the abnormal gradients, prevailing in these conditions of rapid convection, with these normal gradients. The differences between these two systems of gradients represent the energy which produces these atmospheric motions, and any explanation of the *cause of the change of the gradients from the normal to the abnormal, or convectional types*, is undoubtedly a direct contribution to the scientific theory of the local circulations of the air. The Barometry Report has furnished us for the first time with the data for constructing the isobars on the higher levels, as is shown on the charts published in the MONTHLY WEATHER REVIEW for January and February, 1903. The series of charts containing the daily isobars on three planes lays bare the mechanism of the dynamic structure in cyclones and anticyclones, so that it is necessary to develop a mathematical analysis in conformity with the observed facts. Furthermore, the same Barometry Report has furnished us with reliable annual residuals, or the variation of the pressure from year to year, and it has been shown in the MONTHLY WEATHER REVIEW for July, 1902,[1] that these residuals synchronize with similar pressure variations over the entire earth, and also to some extent with the annual variations in the frequency numbers of the solar prominences, faculæ, and sunspots. These facts suggest the foundation for the true cosmical meteorology of the future. These three lines of study—namely, (1) the abnormal system of convectional gradients, (2) the normal gradients when there are no vertical currents, and (3) the solar-terrestrial synchronous variations—can be developed with accuracy for the United States, and placed upon a strictly scientific basis. Could similar material be computed for several other parts of the earth, the whole cosmical research would be distinctly advanced from an empirical to a thoroughly scientific status. The point of view can be illustrated by employing the data obtained from the Cottage City waterspout, Table 51.

[1] Vol. XXX, pp. 347–354.

TABLE 51.—*Summary of the data for the Cottage City waterspout, August 19, 1896.*

Stages.		Metric system.					English system.					
		H. photo.	Height.	*B.*	*t.*	*e.*	H. photo.	Height.	*B.*	*t.*	*e.*	Gradient.
		mm.	*Meters.*	*mm.*	°*C.*	*mm.*	*Inches.*	*Feet.*	*Inches.*	°*F.*	*Inches.*	
δ-stage	Upper	176.4	4942	414.5	− 12.0	1.64	6.95	16,214	16.32	10.4	0.065	
					Gradients.					Gradients.		
	Range	73.6	2062	− 6.04 − 6.50	− .582 − .550	− .142 − .140	2.90	6,765	− .072 − .078	− .319 − .302	− .00170 − .00169	(G) Observed. (G) Cloud.
	Lower	102.8	2880	539.0	0	4.57	4.05	9,449	21.22	32.0	0.180	
γ-stage		2.6	74	− 6.76			0.10	243	− .082			(G) Observed.
β-stage	Upper	100.2	2806	544.0	0	4.57	3.95	9,206	21.42	32.0	0.180	
					Gradients.					Gradients.		
	Range	61.7	1728	− 7.40 − 7.60 − 7.11	− .538 − .540 − .376	− .240 − .260 − .364	2.43	5,669	− .089 − .091 − .085	− .294 − .294 − .207	− .00288 − .00312 − .00437	(G) Observed. (G) Cloud. (G) Barometry.
	Lower	38.5	1078	672.0	9.3	8.72	1.52	3,537	26.46	48.7	0.343	
α-stage	Upper				Gradients.					Gradients.		
	Range	38.5	1078	− 8.46 − 8.40 − 8.24	− 0.965 − 0.950 − 0.375	− 0.204 − 0.192 − 0.296	1.52	3,537	− 0.101 − 0.101 − 0.098	− 0.531 − 0.522 − 0.206	− 0.00246 − 0.00230 − 0.00355	(G) Observed. (G) Cloud. (G) Barometry.
	Sea level	0	0	763.27	19.72	10.92	0	0	30.05	67.5	0.430	

(2) In the temperature of the *α*-stage the normal gradient is −0.206 F. per 100 feet, and the waterspout gradient is −0.531, which is only a little short of the true adiabatic gradient. The normal temperature fall from the sea level is −7.3°, or a change from 67.5° to 60.2°, at the 3537-foot level. This change from the normal temperature fall (which is small on the Atlantic coast in summer because of the southward bending of the isotherms over the ocean areas) to the adiabatic convectional gradient is a very striking fact. The latter gives a fall of −18.8° F., or a fall from 67.5° to 48.7° F., instead of to the normal temperature 60.2° F., *showing that something has occurred to suddenly reduce the normal temperature at the 3537-foot level by the amount 11.5° F.*

The cause of this will be explained in the following paragraph.

(3) The normal gradient of the vapor pressure is −0.00355 inch per 100 feet, for Nantucket in August, and this gives a total fall of −0.126 inch, or a change from 0.430 at sea level to 0.304 at the cloud base. The abnormal or convectional gradient prevailing at the waterspout is 0.00246, which makes a change of −0.087, or a diminution of the normal vapor pressure 0.430 to 0.343. Thus, we have a gain of 0.039 in the vapor tension for the waterspout. The result for the *α*-stage is a total *decrease* of the pressure by −0.110 inch, a total *decrease* in the temperature by 11.5° and a total *increase* in the vapor tension by 0.039 inch. This must be interpreted to mean that the air is rising from the sea level, carrying with it aqueous vapor into levels of temperature about −11.5° F. lower than that which prevails in the normal August weather.

(4) The depth of the *α*-stage is 3537 feet, of the *β*-stage 5669 feet, of the *γ*-stage 243 feet, and of the *δ*-stage 6765 feet, to the assumed top of the cumulo-nimbus cloud. In the *β*-stage the pressure gradient changes from the normal rate −0.085, to the convection rate −0.089 per 100 feet. This is equivalent to a fall of −4.82 inches in the normal state, from 26.58 to 21.76 inches; and to a fall of −5.04 in the convection cloud, from 26.46 to 21.42 inches. There is, therefore, a total fall in pressure of −0.227 inch, (−.004 × 56.7 = − 0.227), induced by the change from the normal to the waterspout conditions in the *β*-stage of the cloud. We have thus a differential gradient per 100 feet in the *α*-stage of −0.0031, and in the *β*-stage of −0.0041 inch in favor of a vertical current. The excess in the *β*-stage over the *α*-stage of −0.0010 inch may be taken as the effective gradient due to the additional latent heat produced by the condensation of the aqueous vapor to liquid water. *This is only one-third the amount of the gradient due to the cause which produces the general uplift of the air that feeds the cloud.* This criterion also proves that there is a more efficient cause for the vertical pressure gradient than the condensation of the aqueous vapor, which has been so generally considered by meteorologists to be the true source of the energy that drives cyclones, following Espy's suggestion of fifty years ago.

(5) The temperature gradient in the *β*-stage changes, derived for the normal, is −0.207° F. per 100 feet, and −0.294° F. per 100 feet in the cloud. This amounts to a fall of −11.7° F. in 5667 for the normal state, and −16.7° F. for the convectional state, carrying the normal temperature from 60.2° to 48.5° F. in the *β*-stratum, and from 48.7° to 32.0° F. in the actual *β*-stage of the waterspout cloud. This is equivalent to a gradient excess in the *α*-stage of −0.325 of the convection over the normal gradient, and in the *β*-stage is one-fourth that in the *α*-stage. In the case of the pressure the excess in the *β*-stage is four-thirds that in the *α*-stage. The temperature difference of gradient diminishes rapidly in proportion to the height up to the *γ*-stage. In that stage and the *δ*-stage there is not much difference between the normal and the computed convectional gradients. This indicates that the effective cause of a vertical gradient is about exhausted at the height where the isotherms of the 0° is located, or, in other words that the *vertical convectional action is properly confined in the waterspout cloud to within about two miles of the ground, and is most active in the lower portion of the cloud.* In cyclones this vertical convection is usually limited to within two or three miles of the ground, though the accompanying dynamic action may penetrate into the upper strata as high as three or four miles; in hurricanes the penetration reaches to six or seven miles at least.

(6) In the *β*-stage the gradient of the vapor tension changes from the normal −0.00437 per 100 feet to −0.00288; the total fall in 5669 feet amounts to −0.248 inch, (−0.00437 × 56.7 = −0.248), in the normal, to −0.163 in the cloud convection, making the fall which should be from 0.304 to 0.056 in the normal state, from 0.343 to 0.180 in the cloud. The difference of gradient is +0.00109 per 100 feet in the *α*-stage, and +0.00149 in the *β*-stage, showing that large quantities of vapor are carried upward from the sea level in both stages, but that there is a condensation of aqueous vapor to water equivalent to +0.00040 inch per 100 feet. We can not carry out this comparison between the normal and the convectional gradients in the *γ*-stage and the *δ*-stage, but the evidence is that they have become practically identical.

(7) It is desirable to compare these vertical gradients with the commonly observed horizontal gradients. We have in the pressure —0.34 inch in 9206 feet. This is equivalent to —13.47 inches in 364,525 feet, or 111,111 meters, or one degree in the standard latitude of forty-five degrees. Now, on the weather maps, —0.70 inch in five degrees, or —0.14 inch in one degree, is the average horizontal gradient in a highly developed cyclone. Hence, in the convectional cloud formation the vertical gradient is about one hundred times as large as in such horizontal motions. In the temperature the fall of —16.5° in 9206 feet is equivalent to —654° in 111,111 meters, or one degree, and this too is about one hundred times the horizontal gradients which are found on the weather maps. This indicates that *the scale of operations on the horizontal plane is only one hundredth that which occurs in the vertical direction in convectional clouds.* The linear dimensions of cyclones are usually about one hundred on the horizontal to one in the vertical direction, and these two facts, taken together, show how much less force is required to drive a horizontal than a vertical current.

THE CAUSE OF THE FORMATION OF THE WATERSPOUT CLOUD, AND THE VERTICAL CONVECTIONAL VELOCITY.

(1) *Vertical convection due to surface heating.*—We now reach the important question, what was the physical cause of the formation of the cloud, and the vertical convection within it that was the immediate condition of the generation of the vortex tube extending from the base to the ocean? Fortunately, one answer to this question is entirely excluded from our consideration. The disturbance of the normal stratification which produces an abnormal system of gradients and the corresponding vertical currents, may be due to two causes, (1) the surface layers may be overheated relatively to the upper layers, or (2) the upper layers may be undercooled relatively to the surface layers. Either cause would be equally efficient, and it is only a question of which one is actually operating in the case of this waterspout. Overheating the surface layers is due to a perfectly definite physical process, namely, as follows. The effective solar radiation falling upon the earth's atmosphere consists of short wave lengths from 0.30 μ to 2.00μ. (Compare figs. 3 and 4, Tables 1 and 2 of my paper on "Solar and terrestrial physical processes," MONTHLY WEATHER REVIEW, December, 1902, Vol. XXX, pp. 562–564.) These short waves, whatever may be the true effective solar temperature at which they are produced, penetrate to the surface of the earth with two sources of depletion, the first, by scattering in the upper atmosphere which cuts out a large percentage of them, and produces the strong glare that is characteristic of the higher layers; the second, by absorption in the aqueous vapor at certain wave lengths, which causes the observed depressions or cold bands in the energy spectrum. There is good reason for believing that the upper as well as the lower atmosphere is heated by the passage of the remainder of the short waves by only a very slight amount, and that this is practically negligible in general discussions. But these short rays falling upon the surface of the earth are readily absorbed, and this absorption powerfully raises the temperature of the land and ocean areas. That practically ends the history of the incoming solar radiation.

The terrestrial radiation, on the other hand, is of an entirely different character, and it has a very different effect upon the earth's atmosphere. The heat radiations at terrestrial temperatures, where the absolute temperature ranges from T=200° to T=325°, have wave lengths extending from 2μ to 40μ, and, thus the outgoing wave lengths begin where the incoming lengths end. Many of these long waves, in radiating from the surface of the earth, are quite readily absorbed by the atmosphere, and the heat percolates from the lower through the upper strata by a process of slow conduction and convection. The aqueous vapor certainly absorbs many waves, as from 4μ to 8μ, and possibly most of the waves beyond 12μ. It was shown very distinctly in my International Cloud Report that the surface temperatures do not diminish with the height at an adiabatic rate, but much more slowly, as is indicated on charts 78 and 79. In Table 162 of the same report is given the number of calories per kilogram required to convert an adiabatic atmosphere into the actual atmosphere as observed. It shows an increase from the ground until the number is about 9.5 calories at the 13,000-meter level in summer and 11.0 calories in winter. This amount of heat may be taken to represent the effect of the outward flowing flux, which, like a slow conduction, keeps the upper atmosphere warmer than it would be if the outward-going waves had the same length as the inward-coming waves. This difference in wave length is the most important factor in the economy of the earth's atmospheric temperatures.

We may now fix our attention more closely upon the changes in the surface temperatures as measured in the normal diurnal and annual periods, and in the local variations of all kinds upon the average conditions. The change in the transparency of the atmosphere due to cloudiness, the difference of altitude of the sun, the character of the surface, whether water area, moist ground, or dry desert, all determine the effective temperature of the surface at any given time. These react upon the corresponding outgoing radiation, which first heats up the lowest strata of the atmosphere, or cools it, according to the prevailing conditions. Strong surface heating by day and cooling by night is, therefore, the regimen to which these layers are subject, and the integral effect of this action in its passage through the upper layers, finally builds up the observed normal gradients of temperature which by no means produce an abiabatic rate of stratification. Temporary convectional currents upward by day, downward by night, upward in some local areas, downward in other areas, constitute the common types of motion due to these causes. The formation of the lower cumulus clouds with moderate convection, of thunderstorms in strong convection, and of desert sand vortices are typical examples of purely surface overheating with vertical convection. But there is an entirely different class of vertical convection, to which sufficient attention has not been paid in meteorological investigations.

(2) *Vertical convection due to the overflow of cold upon warm currents of air.*—It is evident that the vertical convection in the cumulo-nimbus cloud of the Cottage City waterspout could by no possibility have been due to the overheating of the surface by the incoming solar radiation. The phenomenon occurred over the ocean and all the meteorological data of Table 50 show that there was actually no superheating effect near the surface at that time. The prevailing temperature was 67.5° F., while the normal for the month of August at Nantucket was 67.7° F.; and the humidity was 64 per cent, while the normal was 84.3 per cent. *In fact, the 19th of August, 1896, was the driest day of the entire month,* and the powerful vertical convection then taking place could not have been due to the solar radiation acting on the surface conditions. We must, therefore, look for another efficient principle capable of producing the powerful effects shown in the showers preceding the family of waterspouts and the thunderstorm with downfall of hail following them. This we can readily discover by referring to the weather chart of the date, August 19, 1896, fig. 37.

This map shows that a well-defined area of high pressure was just pushing its southeastern front over Vineyard Sound, that the winds were from the northwest, and that there was a fall in temperature of about 15° along the coast line, due to the advance of this cold area. We have, therefore, merely to assume, in accordance with the general fact, that the upper strata are moving eastward in advance of the lower, and that this cold air from the high area was blown forward over Vine-

yard Sound earlier in the strata a mile or two high than at the surface.

A sheet of cold air overran the low, warm, and quiet strata about midday, while the cold air followed at the surface a few hours later, and in these facts we have the exact conditions required to produce the observed powerful convection. Such abnormal cooling of the higher strata is as efficient in producing vertical convectional gradients as a superheating of the surface would be, and the evidence that this was the actual case is so good as to render it a practical proof of this circumstance. The upper strata were cooled suddenly by −12° to −15° F., and this brought showers, the waterspouts, and the thunderstorms in close succession. These were followed later by cooler conditions at the surface, giving a temperature fall from the maximum of the day, 72°, to the minimum, 56.5°, at Vineyard Haven. Under these conditions all the observed facts find so natural and satisfactory an explanation that no further remarks seem to be needed to enforce the theory.

But, it should be noted that this overflow of relatively cold layers of air at a moderate elevation upon the warm surface layers, this forereaching and temporary stratification causes an abnormal system of gradients which produce the vertical currents required to set up the motions that tend to reestablish the normal equilibrium of the atmosphere. This local disturbance of the average gradients, due to the fact that the cold upper air, under certain configurations of the lower currents, is drifted forward upon them, is the *primary cause of most of the phenomena classified as thunderstorms, tornadoes, cyclones, and hurricanes.* In short, all these violent local disturbances of the lower air are largely due to this cause, and this is the true source of the energy expended, though it has been attributed by one school of meterologists to the latent heat of condensation, and by the other school to the eddies established by differential horizontal velocities. These two latter sources of energy need not be excluded from consideration, for they contribute their quota to the total energy of circulation, but the first cause is the abnormal stratification of the air at moderate elevations. Thus the groups of thunderstorms which frequent the southeastern quadrants of the cyclone are due to the overflowing of the cold northern current upon the warm current from the south. Tornadoes have the same origin and their location shows that they are due to this cause. The cyclone itself is generated by warm currents of air from the Tropics underrunning the cold sheet which rotates above the surface of the earth, in the hemispherical whirl north of latitude 35°.

The reason for the outflow of warm currents from the Tropics has been indicated in the International Cloud Report, chapters 8 and 10; also there will be found in the MONTHLY WEATHER REVIEW for January and February, 1903, and in the preceding papers of this series, further illustrations and remarks on this theory. The West Indian hurricanes in a similar way are produced in the late summer and autumn by the overflow of the cool upper sheet from the North American Continent upon the warm tropical lower strata, because this sheet is then increasing in size with the southward retreat of the sun. The withdrawal of the sun to the south in fact brings the thermal equator of the higher strata toward the geographical equator earlier than that corresponding to the lower strata. Hence, relatively cold air from the temperate zones at considerable heights, begins to overlay the tropical warm and moist lower strata, and this induces the long continued vertical convection, localized in the hurricane vortex, which in its progressive movement may traverse thousands of miles along its parabolic track. The form of the track is due to the influence of the general circulation localized in centers of action, which builds the south Atlantic high area on the ocean and is manifested in the trade winds, so that the hurricanes usually gyrate along the edge of this special configuration.

The power which is expended for days in succession in a hurricane is due to the fact that the wide expanse of the upper cold sheet covers the temperate zones and overlaps the Tropics at moderate heights. As long as this contrast of temperature, due to abnormal stratification, continues, there is a sufficient source of energy in the resulting thermal engine to produce powerful vertical convection currents, and to sustain the most violent hurricanes, in which the vortex has a depth of several miles in a vertical direction. This theory seems to harmonize completely with what is known about the meteorology of the lower air, and to be such a satisfactory escape from the difficulties of (1) the condensation theory and (2) the dynamic eddy theory, which have always encountered both practical and theoretical objections, that we may expect to find confirmation of it in the future development of the mechanics of the atmosphere.

VARIATION IN TEMPERATURE OVER A LIMITED AREA.

By Prof. Willis I. Milham, Ph. D. Dated Williamstown, Mass., August 4, 1906.

I. INTRODUCTION.

The investigation of the variation in temperature over a limited area was continued and completed during the winter of 1905–6, and the present article contains the results of this investigation. The limited area in question is the village of Williamstown, Mass., which is about one and one-half miles long and three-quarters of a mile wide, and is situated on three small knolls in the middle of a larger depression. It consists of detached houses, surrounded by ample lawns and gardens, and has a diversified surface made up of fairly level areas, marked valleys, plenty of running water, and differences of elevation amounting to 120 feet.

One phase of the variation was investigated during the winter of 1904–5 and the results were published in the MONTHLY WEATHER REVIEW for July, 1905, Vol. XXXIII, page 305, under the title: "The variation in minimum temperatures on still, clear nights within the confines of a village". Here may also be found a complete description of the village, together with an accurate topographical map. A brief summary of that investigation will be useful as a preface for the present article. Accurate, self-registering, minimum thermometers of the regular Weather Bureau type were mounted in exactly the same way and exposed at ten different stations in the village. As long as the ground was covered with snow, their readings were noted whenever a decided fall in temperature occurred during the night. The maximum variation noted was 10° F. and the average variation for the thirty-six nights on which observations were taken was 5.1°. It was furthermore found that the variation was much less on a windy night, that it was not influenced by the coldness of the night, and that it was greatest on two different, carefully described types of nights. It was also found that air colder and thus more dense tended to drain into the valleys; but elevation was not the all-determining factor, for the openness of the valley, its direction, the roughness of its surface, and the wind direction also played a part. The regularity with which certain stations were either warmer or colder than other stations was investigated and it was found that one station proved to be quite constantly the coldest and another the warmest in the series of ten.

In order to determine completely the behavior of a limited area as regards variation in temperature, two more questions must be investigated. These questions are: (1) Does any variation in temperature exist during the daytime? (2) Does the variation remain constant during a given night, or does it change and perhaps grow larger as the time of minimum temperature approaches? It is the purpose of this article first to answer these two questions and then to summarize the results and give a complete picture of the behavior of a limited area as regards variation in temperature.

For the investigation of the above questions two stations were chosen, and these were naturally the two which had proved themselves to be the warmest and coldest during the previous investigation. This choice was determined by the consideration that if a variation in temperature over the limited area was to be found, it would certainly show itself between the stations which had been found to be warmest and coldest. These stations have a difference of elevation of 66 feet, the elevation of the thermometer at one being 706.5 and at the other 640.5 feet. In this article these stations will be spoken of as the upper and lower. They correspond exactly to station 8 (warmest) and station 7 (coldest) of the previous investigation. The upper station is located near the top of a knoll and is surrounded by a fairly level field for a few hundred feet on every side. The lower station is at the bottom of a valley, 1700 feet northwest of the upper station. The topographical map referred to above shows in detail the surroundings of these stations.

II. VARIATION IN TEMPERATURE DURING THE DAYTIME.

The daytime temperatures at the two stations were determined by means of an Assmann's ventilated thermometer made by R. Fuess, of Berlin. This instrument is now too well known to need description, and can be relied upon to determine the real air temperature correctly to at least 0.1° F. even in bright sunshine. The observations made on twelve different days during the winter are given in Table 1. Those days in particular were chosen when there was plenty of sunshine and the wind velocity was small. In fact, the table contains observations on every bright, sunny day with small wind velocity as long as the ground was covered with snow. If no variation can be detected on such days, surely none can be expected when the wind velocity is high and the sky is overcast. The first column contains the date and time of observation. The time indicated is always that for the observation at the lower station. The temperature given for the upper station is the mean of two temperatures taken the same number of minutes before and after the observation at the lower station. These two temperatures never differed by more than a few tenths of a degree at most. The wind velocities given in this table, and all subsequent tables, were determined by a watch-pattern anemometer and also by noting the rapidity of drift of smoke from a chimney, or one's breath, or some light object. The anemometer was calibrated by walking with a known speed both against and with the wind. The absolute values of these wind velocities may be somewhat erroneous, but they will nevertheless serve to indicate the relative windiness at the different times of observation. The ventilated thermometer was held exactly five and one-half feet above the surface of the ground in determining a temperature, and the wind velocity was observed at this same height.

TABLE 1.—*Temperature observations at two stations in Williamstown, Mass., during the daytime.*

Date and time.	Station.		Wind direction and velocity, miles per hour.	Character of the sky.	Depth of snow on ground.	Remarks.
	Upper.	Lower.				
1905.	° F.	° F.			*Inches.*	
Dec. 1, 2:15 p. m.	23.5	23.5	nw., 5	Cloudless	0	Dry, frozen ground.
Dec. 5, 2:40 p. m.	25.7	26.0	nw., 3	Partly cloudy.	0.3	
Dec. 13, 2:30 p. m.	37.9	37.9	w., 3	Overcast	2.0	Melting snow.
Dec. 16, 3:00 p. m.	24.8	24.8	nw., 1	Cloudless	1.0	
1906.						
Jan. 10, 2:35 p. m.	20.8	20.5	se., 2	Light haze	3.0	New snow.
Jan. 11, 2:15 p. m.	36.5	36.5	se., 2	Overcast	3.0	
Feb. 3, 2:50 p. m.	12.6	12.9	n., 3	Cloudless	Trace.	
Feb. 6, 2:40 p. m.	1.3	1.8	nw., 2	Cloudless	1.0	
Feb. 8, 2:40 p. m.	15.8	16.2	nw., 4	Cloudless	1.0	
Feb. 17, 2:15 p. m.	31.8	31.8	nw., 2	Cloudless	13.0	
March 14, 2:45 p. m.	25.0	25.2	nw., 5	Cloudless	Trace.	
March 24, 2:15 p. m.	23.4	24.3	nw., 3	Cloudless	5.0	

It will be seen that the variation is extremely small. The largest value is 0.9° and the average for the twelve days is 0.19°, the lower station being the warmer. If the three days are excluded when there was only a trace of snow upon the ground, the average variation is 0.20°. The higher temperature on the part of the lower station is analogous to what is found on a much larger scale in connection with mountain and valley stations. Wind velocity is much greater during the day than at night, and convection is operative only during the daytime. It would seem that these two processes are sufficient to so thoroughly mix the lower layers of the air that a variation in temperature over a limited area during the daytime is hardly to be detected. In considering the amount of the variation found on these days it must be noted that these are extreme cases. In the first place, the warmest and coldest stations in the limited area were chosen; secondly, those days were chosen when the variation would be largest; and finally, the observations were taken at the most favorable time of day for a variation.

III. VARIATION IN TEMPERATURE DURING THE THREE TYPES OF NIGHTS.

The two thermometers used to determine the temperature during the night and the minimum temperatures were self-registering, minimum, alcohol thermometers of the regular Weather Bureau type. In order to eliminate the possibility of inaccuracies in the thermometers as the cause of the variations noted, the following precautions were taken: (1) The two thermometers were wrapped up together in cloth and placed in a room where the temperature was nearly constant. At the end of several hours the two thermometers indicated the same temperature. This was done at the beginning and end of the experiment and for several different temperatures. (2) The thermometers were read on several different occasions during a high wind while the temperature was nearly stationary, either at night or when the sky was overcast. No difference was found on such occasions. (3) The two thermometers were frequently interchanged.

The use of identical thermometers is absolutely essential. Two thermometers of radically different form and construction may indicate the same temperature when wrapped up together in a constant temperature room, and yet when exposed in the open at night they may, in extreme cases, show a difference of even several degrees. The thermometers were mounted on unpainted pine boards about eighteen inches long and seven inches wide, and were exposed in the open, without a shelter of any kind, exactly five and one-half feet from the surface of the ground. They were exposed on the northwest side of small trees, at least twenty-five feet from the nearest building, and with a much larger clear space on the northwest side. Most of the observations were taken over a snow surface. Absolute identity of thermometer, mounting, exposure, and surface can not be emphasized too strongly, for many of the reported variations in temperature over limited areas are due simply to the fact that the thermometers, although accurate, are different, or are mounted and exposed in a different way. These thermometers do not, of course, indicate the real air temperature, even at night when exposed in the open. Owing to radiation their indications may be anywhere from a small fraction of a degree to, in extreme cases, several degrees below (never above) the real air temperature. When two identical instruments are mounted and exposed in the same way, it can be safely assumed that both are affected alike, and read the same amount below the real air temperature.

From December until April there were twenty-one nights during which variations in temperature betwen the two stations occurred. It was found that these nights could be divided into three groups, each with marked characteristics of its own. The observations for the eleven nights of the first type are given in full in Table 2. The first column contains the date and time of observation. The time indicated is always that for the observation at the lower station. The thermometer at the upper station was always read the same number of minutes before and after the observation at the lower station,

and the temperature given for the upper station is the mean of these two readings. The method of obtaining the wind velocities was explained above.

TABLE 2.—*Temperature observations at two stations in Williamstown, Mass., during nights of the first type.*

TYPE I.

Date and time.	Station. Upper.	Station. Lower.	Wind direction and velocity, miles per hour.	Character of the sky.	Depth of snow on ground.	Remarks.
1905.	°F.	°F.			Inches.	
Nov. 30–Dec. 1, 3:33 p.m	17.2	18.0	nw., 18	Cloudless	0.0	Dry, frozen ground.
Dec. 1, 5:23 p.m	12.9	12.5	nw., 16	Cloudless	0.0	
Dec. 1, 10:32 p.m	9.2	9.0	nw., 10	Cloudless	0.0	
Min.	6.5	5.3	nw., 3	Cloudless	0.0	Minimum at sunrise.
1906.						
Feb. 2-3, 5:20 p.m	0.9	1.0	nw., 15	Cloudless	0.3	
10:00 p.m	— 0.5	0.0	nw., 10	Cloudless	0.3	Wind gusty.
Min.	— 7.5	— 8.0	nw., 3	Cloudless	0.3	Minimum at sunrise.
Feb. 5-6, 7:30 p.m	3.3	3.5	nw., 12	Cloudless	2.0	
10:40 p.m	— 1.8	— 1.5	nw., 4	Cloudless	2.0	
Min.	—10.8	—13.7	nw., 1	Cloudless	2.0	Minimum at sunrise.
Feb. 10-11, 5:30 p.m	20.9	21.0	nw., 10	Partly cloudy.	11.0	
10:55 p.m	12.0	12.2	nw., 10	Cloudless	11.0	
Min.	—10.5	—18.0	0	Cloudless	11.0	Minimum at sunrise.
Feb. 15-16, 5:50 p.m	9.0	9.0	nw., 12	Overcast	14.0	
8:35 p.m	7.4	7.5	nw., 4	Overcast	14.0	
10:45 p.m	5.2	5.2	nw., 3	Overcast	14.0	
Min.	—10.9	—20.0	0	Cloudless	14.0	Minimum at sunrise.
Feb. 22-23, 5:50 p.m	29.3	29.5	nw., 12	Cloudless	Trace.	Snow in patches, dirty.
10:36 p.m	24.5	24.5	nw., 3	Cloudless	Trace.	
Min.	18.0	14.0	nw., 1	Cloudless	Trace.	Minimum at sunrise.
Mar. 14-15, 7:10 p.m	18.4	18.0	nw., 1	Cloudless	Trace.	
10:40 p.m	14.0	13.0	nw., ½	Cloudless	Trace.	
Min.	11.9	8.5	0	Overcast	Trace.	Minimum at 3 a.m.
Mar. 17-18, 7:05 p.m	18.0	18.0	nw., 8	Cloudless	4.0	New snow.
10:50 p.m	15.0	15.0	nw., 6	Cloudy	4.0	
Min.	7.5	— 1.0	0	Cloudless	4.0	Minimum at sunrise.
Mar. 18-19, 7:40 p.m	20.0	20.0	nw., 3	Cloudless	3.0	
10:40 p.m	16.0	8.0	0	Cloudless	3.0	
Min.	7.2	— 2.0	0	Cloudless	3.0	Minimum at sunrise.
Mar. 22-23, 5:50 p.m	17.1	17.0	nw., 7	Cloudless	6.0	
11:00 p.m	13.0	13.0	nw., 4	Cloudless	6.0	Wind gusty.
Min.	7.8	7.7	nw., 3	Cloudless	6.0	Minimum at sunrise.
Mar. 23-24, 5:40 p.m	13.0	13.0	nw., 10	Cloudless	5.0	
10:35 p.m	9.0	8.0	nw., 3	Cloudless	5.0	
Min.	— 2.9	—10.5	0	Cloudless	5.0	Minimum at sunrise.

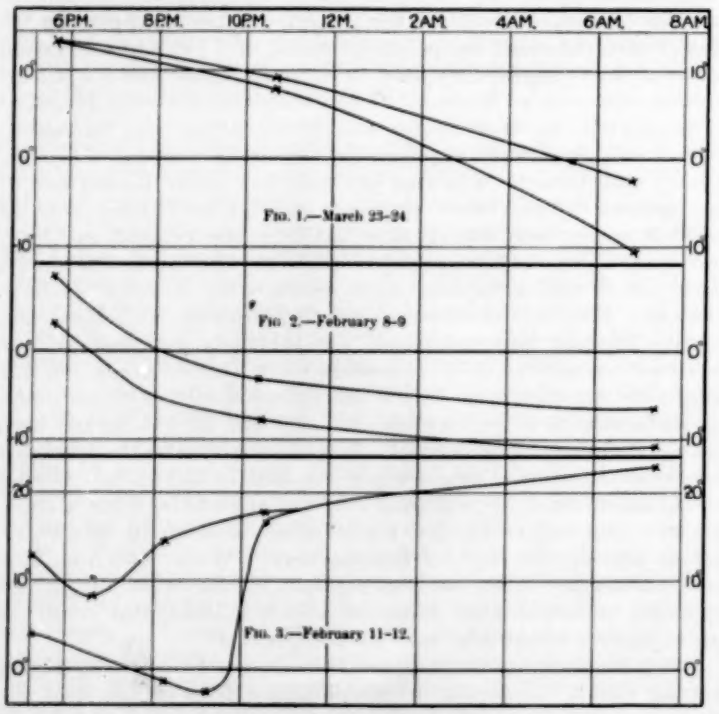

FIG. 1.—March 23-24

FIG. 2.—February 8-9

FIG. 3.—February 11-12.

Temperature variations.

The chief characteristics of this type of night are these: Just after sunset the wind would be from the northwest with a fairly large velocity, in one case as high as eighteen miles per hour. The sky would often be cloudless, but sometimes overcast or partly cloudy. During the night the wind would die down and the sky become clearer. By sunrise, or a little before, when the minimum of temperature usually occurred, the wind would be blowing with a velocity of three miles per hour, or less, and the sky would be cloudless. Often the wind would die down to an absolute calm. As long as the wind velocity remained about three miles per hour, or more, the two stations would show but little variation in temperature. The lower station would often be a small fraction of a degree warmer than the upper station. As soon as the wind velocity fell below about three miles per hour, the variation would begin to appear, and would steadily increase with the dying down of the wind until the time of minimum temperature, when the lower station was always much colder than the upper. In one case (March 19) the difference was 9.2°. The night of March 23–24 is a very characteristic night of this first type, and the observations are printed in black-faced type in Table 2. In fig. 1 these observations are plotted to scale and show graphically the behavior of a limited area during this type of night.

The observations for the eight nights of the second type are given in full in Table 3.

TABLE 3.—*Temperature observations at two stations in Williamstown, Mass., during nights of the second type.*

TYPE II.

Date and time.	Station. Upper.	Station. Lower.	Wind direction and velocity, miles per hour.	Character of the sky.	Depth of snow on ground.	Remarks.
1905.	°F.	°F.			Inches.	
Dec. 1-2, 5:15 p.m	17.8	15.0	se., 1	Cloudless	0.0	Dry, frozen ground.
10:30 p.m	15.0	13.0	se., ½	Light haze	0.0	
Min.	14.5	12.5	se., ½	Light haze	0.0	Minimum, 12:15 a.m.
1906.						
Jan. 10-11, 5:12 p.m	16.8	11.5	se., ½	Cloudless	3.0	New snow.
8:25 p.m	12.0	8.0	se., ½	Cloudless	3.0	
10:40 p.m	13.3	8.0	se., ½	Cloudless	3.0	
Min.	7.9	4.0	0	Light haze	3.0	Minimum, 6:15 a.m.
Feb. 8-9, 5:45 p.m	8.3	3.0	s., 1	Cloudless	1.0	
8:00 p.m	0.5	— 5.5	s., ½	Cloudless	1.0	
10:25 p.m	— 3.1	— 8.0	s., ½	Cloudless	1.0	
Min.	— 6.8	—11.0	0	Cloudless	1.0	Minimum at sunrise.
Feb. 16-17, 5:50 p.m	15.0	5.5	0	Cloudless	14.0	
11:55 p.m	— 1.3	—11.0	se., ½	Cloudless	14.0	
Min.	— 8.8	—17.0	0	Cloudless	14.0	Minimum at sunrise.
Feb. 17-18, 7:10 p.m	14.5	5.0	se., ½	Cloudless	13.0	
11:05 p.m	8.8	— 2.0	se., 1	Cloudless	13.0	
Min.	6.5	— 3.0	se., 1	Cloudless	13.0	Minimum at 1 a.m. Stationary temperature until morning.
Mar. 13-14, 7:27 p.m	16.8	15.0	nw., ½	Hazy	0.5	
10:15 p.m	13.5	11.5	nw., ½	Light haze	0.5	
Min.	13.2	11.2	se., ½	Overcast	0.5	Minimum at 1 a.m.
Mar. 24-25, 6:05 p.m	20.0	17.0	nw., 2	Cloudless	5.0	
10:50 p.m	4.3	— 3.0	se., ½	Cloudless	5.0	
Min.	— 6.0	—12.8	0	Cloudless	5.0	Minimum at sunrise.
Mar. 25-26, 7:00 p.m	27.3	22.0	0	Cloudless	3.0	
10:45 p.m	16.0	9.2	0	Cloudless	3.0	
Min.	12.2	6.0	0	Overcast	3.0	Minimum at sunrise.

The chief characteristics of this type of nights were these: During the whole night from sunset to sunrise the wind velocity was very small. In fact it never exceeded two miles per hour during any one of these eight nights, and it was usually much less than one mile per hour. The wind direction was not uniform, sometimes from the northwest and sometimes from the southeast or south. The sky was usually cloudless, although it sometimes became hazy or overcast before morning. Within an hour after sunset a marked variation in temperature between the two stations was observed, and this variation remained nearly constant during the entire night. The night of February 8–9 is perhaps the most characteristic of this group and the observations have been printed in black-faced type in Table 3 and are plotted to scale in fig. 2.

There were only two nights of the third type during the winter, and the observations for these two are given in full in Table 4.

The change in wind direction is the most characteristic thing about this type of night. In the early evening the wind would be blowing from the northwest with small velocity. It would then die down to a calm in a few hours, change direction

to the southeast and increase again in velocity. The minimum of temperature always came early in the night. The night of February 11–12 is a particularly fine example of this type. The observations are printed in black-faced type in Table 4, and fig. 3 shows them plotted to scale. Several things in connection with this night are worthy of notice. The minimum temperature at the upper station occurred about two hours earlier than at the lower station. This means that the increasing southeast wind replaced the air at the upper station with warmer air, and thus caused a rise in temperature two hours before it was able to remove the pocket of cold air from the lower station. The variation in the minimum temperature on this night was the largest of the winter and amounted to 11.5°. This is 1.5° larger than the largest variation noted during the winter of 1904–5. Although the minimum temperatures differed by 11.5°, at 8:10 p. m. there was a difference in temperature of 16.3° between the two stations.

TABLE 4.—*Temperature observations at two stations in Williamstown, Mass., during nights of the third type.*

TYPE III.

Date and time.	Station.		Wind direction and velocity, miles per hour.	Character of the sky.	Depth of snow on ground.	Remarks.
	Upper.	Lower.				
1906.	°F.	°F.			Inches.	
Feb. 7–8, 5:45 p.m	— 3.0	— 3.0	nw., 3	Cloudless	1.0	
8:00 p.m	— 6.8	— 6.5	nw., 2	Cloudless	1.0	
Min	—11.0	—15.0	nw., 0	Cloudless	1.0	Minimum about 10 p. m. Went steadily up with no variation and increasing wind.
11:40 p.m	— 7.5	— 7.5	se., 2	Overcast	1.0	
Feb. 11–12, 5:10 p.m	13.0	4.0	nw., 4	Cloudless	10.0	
Min	8.5					Minimum at upper station.
8:10 p.m	14.8	— 1.5	se., 1	Cloudless	10.0	
Min		— 3.0				Minimum at lower station.
10:30 p.m	17.3	17.0	se., 6	Partly cloudy	10.0	
Sunrise	23.0	23.0				

As was stated above, a variation in temperature was detected on twenty-one nights, and the nights have been divided into three groups, each with marked characteristics of its own. During all other nights the wind velocity remained above three miles per hour, and it was often stormy or cloudy in addition. Many observations were made at odd times during such nights, but a variation as large as 1° was never detected. During the early morning following a night when a variation in temperature had existed the lower station would become warmer more rapidly than the upper station, so that within an hour or two after sunrise no appreciable variation could be found. This was frequently tested by means of the ventilated thermometer in the early morning an hour or two after sunrise.

Wind direction and velocity are the distinguishing characteristics of the three types of nights which have just been described. During a night of the first type the wind has a fairly high velocity during the first part of the night; it then dies down to a small velocity or an absolute calm without changing direction. During a night of the second type the wind velocity remains very small during the entire night. During a night of the third type the wind is from one direction, with a small velocity in the early evening; it quickly dies down to a calm, changes to the opposite direction, and increases in velocity again. These facts have been restated here to emphasize the importance of wind velocity. For the limited area under investigation, namely, the village of Williamstown, the critical value of wind velocity seems to be about three miles per hour. As long as wind velocity has a greater value than this no variation of any amount can be found; but as soon as it sinks below this value the variation makes its appearance, and its change during the night depends upon the type of night, or, in other words, depends upon the change in wind direction and velocity during the night. The cause of variation in temperature is the interaction of the wind and the drainage of cooler, and thus more dense, air into the valleys. This drainage of cooler air tends to give the places of less elevation a lower temperature. The wind tends to remove this cooler air and mix it with other masses of air, thus maintaining a uniform temperature over the limited area. The ability of the wind to remove this cooler air depends, apart from its velocity, upon the direction of the valley, the direction of the wind, the openness of the valley, and the roughness of its sides. It will thus be seen that, in general, places of less elevation should have a lower temperature at night, but it will also be seen that elevation is not the all-determining factor. On a topographical map of a limited area which had never been investigated, the warmer and colder stations could probably be located with a fair degree of certainty, but the points could not be arranged in order of coldness depending upon elevation alone.

IV. SUMMARY.

Whenever, in this or the former article, mention has been made of a limited area, the village of Williamstown has been the particular limited area to which reference has always been made. The results which have been obtained by investigating this particular limited area for two winters can, however, be generalized so that the behavior of any limited area as regards variation in temperature can be stated. A limited area, in general, can perhaps be best defined as a square mile of surface roughly in the form of a circle or square. During the daytime, on account of convection and the higher values of wind velocity, no appreciable variation in temperature over a limited area will be found. On some particularly favorable days, namely, those with plenty of sunshine and low wind velocity, the lower stations (particularly those in narrow valleys) may be a few tenths of a degree warmer than the upper stations. At night the existence of a variation will depend almost entirely upon the velocity of the wind. For every limited area there will be a critical value of wind velocity. For all ordinary limited areas it will probably not be far from three miles an hour. As long as the wind velocity remains larger than this, no variation in temperature will be found. As soon as the wind velocity sinks below this critical value a variation will begin to be manifest. The change in this variation during the night will depend upon the type of night, and three types of nights, each with marked characteristics of its own, can be distinguished. These three types of nights have been fully described above. The maximum variation which may be expected for an ordinary limited area is from 10° to 15° F. This, however, might vary considerably with different limited areas. All the stations in a limited area can be arranged in a series representing their relative coldness, the lower or valley stations being the colder, and the upper stations the warmer. This series should be determined by observations, however, as elevation is not the all-determining factor. A good idea of which stations should be the colder can be determined from a topographical map of the area.

V. PRACTICAL CONSIDERATIONS.

All temperature data, such as the normal daily, monthly, and yearly temperature, the different values of range, etc., are now computed from the maximum and minimum temperatures which are observed at the station in question. Suppose that two stations had been established, one at the warmest and another at the coldest point in Williamstown; the normal yearly temperature, for example, at these two stations would show a difference of probably more than a degree, and the values of range would show a difference of several times that amount. The point to emphasize is the effect on climatological data of the choice of a station within a limited area. It is often stated that for climatological data and charts, the re-

sults of observations made at cooperative stations of the Weather Bureau, which are usually located in a village or small city, are to be preferred to those made at regular Weather Bureau stations, as these are usually located in large and growing cities. Very little is usually known of the limited area which surrounds a cooperative station, and yet the choice of location in such an area would probably affect the data as much as the presence of a city.

In order to investigate the effect of a city on regular stations and get more accurate climatological data, a substation just outside the city is now often maintained. It would seem that still more valuable information would be gained if the limited area about such a substation were investigated for two or three years and then two stations established, one at the warmest and the other at the coldest point.

MONTHLY REVIEW OF THE PROGRESS OF CLIMATOLOGY THROUGHOUT THE WORLD.

By C. FITZHUGH TALMAN, U. S. Weather Bureau.

CHARTS SHOWING THE DISTRIBUTION OF CLIMATOLOGICAL STATIONS.

Next to a complete climatological dictionary, or compilation of climatic normals for the world, perhaps the greatest desideratum in the way of climatological literature is an atlas and gazetteer of meteorological stations.[1] Charts showing the distribution of stations of all orders are especially desirable, as they enable one to determine exactly, at a glance, at what points on the earth's surface climatological observations are being carried on. Such charts are published by a few, but only a few, of the climatological services of the world, in connection with their periodical reports. (For the United States they are published in the annual summaries of the section reports issued by the Climatological Service of the Weather Bureau.)

With the approval of the Editor of the MONTHLY WEATHER REVIEW the writer intends to include in this column, from month to month, sketch maps showing the location of meteorological stations in various countries, especially those in which meteorological work on an extensive scale has but recently begun. Space will not generally permit lists of the stations to be included, nor any detailed statistics concerning them, but it is hoped that the charts alone will prove an acceptable contribution to climatology. In some cases these charts will be reprints of those that appear in various foreign publications to which but few readers of the REVIEW have access; but more often they will be especially prepared for the REVIEW, on the basis of the most recent information obtainable, by correspondence and otherwise.

We begin the series with the chart accompanying the following note.

A NEW CLIMATOLOGICAL SERVICE IN SICILY.

Following the example of the observatories of Palermo and Catania, which have established numerous thermopluviometric stations in their respective provinces, the observatory of Messina has inaugurated a network of such stations in the province of Messina. Their distribution is shown by the accompanying chart, fig. 1. The greater part of these stations began their observations January 1, 1906, and the results are to be published hereafter in the Annuario of the observatory of Messina.

The director of this service, and of the observatory, is the well-known meteorologist, geophysicist, and astrophysicist, G. B. Rizzo. Since 1904 the observatory has formed a part of the Royal University of Messina.

THE CLIMATOLOGICAL ATLAS OF INDIA.[2]

The appearance of this work has been awaited with general interest by the meteorological world since the publication, in Indian Meteorological Memoirs, vol. 17 (Calcutta, 1904), of the numerical data upon which it is based, accompanied by the announcement that the publication of the atlas had been sanctioned by the government of India. Now that the atlas is before us, we learn that a Handbook of the Meteorology of India is in preparation, which, with the atlas, will form a complete work, each part supplementing the other, and be a record of the more important results of meteorological observation and investigation in India during the period 1876–1900.

The Climatological Atlas of India takes its place beside Hellmann's rainfall volumes for Germany (see July REVIEW, p. 328), as one of the two great contributions to geographical climatology that have appeared so far this year. As to the authoritative character of this work and the excellence of its mechanical execution, it need only be said that its author is Sir John Eliot, the late meteorological reporter to the government of India, and the publishers are Messrs. Bartholomew & Co., who produced the beautiful Bartholomew-Herbertson-Buchan Atlas of Meteorology (Bartholomew's Physical Atlas, vol. 3).

In order to see how much of an advance the new atlas represents in the graphical presentation of Indian climate, the writer has compared the charts of pressure and temperature, respectively, with Buchan's pressure charts of the globe in the Challenger Report (1889, reprinted on a small scale in Bartholomew's Atlas of Meteorology, 1899) and Buchan's isothermal charts for India in Bartholomew's Atlas of Meteorology, plate 9 (based on manuscript maps prepared for the Challenger Report). On the July pressure charts it is noted that the heart of the Asiatic summer "low" lies well up the Indus Valley, instead of along the northern shore of the Arabian Sea, where Buchan puts it. There are many other important readjustments of the isobars, especially in northern India. It is noticed, however, that on the large plates (7–10), showing the distribution of pressure over southern Asia and the Indian Ocean, Buchan's isobars have been copied exactly, except over India itself, so that these plates hardly represent the most recent knowledge of pressure distribution over the Indian monsoon area. The isothermal charts in many places differ strikingly from Buchan's, and show how greatly the latter stood in need of revision in the light of recently accumulated data.

Besides the 120 plates embraced in this work, representing the normal distribution and fluctuations of all the principal meteorological elements over India, there are 32 folio pages of letter-press, containing, among other things, the best brief history of meteorological work in India that has yet appeared

THE FOGS OF RUWENZORI.

That this much talked of mountain baffled the efforts of some of the world's most expert mountaineers to scale its loftier summits until the present summer, when the feat was accomplished by the Duke of the Abruzzi, was not due to the configuration of the mountain, which appears to offer no difficulties not easily surmountable by the ordinary expedients of mountaineering, but to the fog or cloud in which the upper levels are almost constantly enwrapped.

Lieutenant Behrens, R. E., writing on "The snow peaks of Ruwenzori", in the Geographical Journal for July, says:

> Though for nine months in a neighborhood from which, on most days, Ruwenzori might have been visible from my tent, I saw it only seven times, and then only for a few minutes just after sunrise. So

[1] An ideal work of this character would include former stations as well as those now in operation, providing they furnished trustworthy observations for a reasonably long period. (For the latter no absolute limit should be fixed. A station in the heart of Asia represented by six months of observations would be well worth including; whereas in Germany, with its 3000 stations, those having less than two years of observations could very well be ignored, if no longer in operation.) The work would then have a permanent value, regardless of the changes that are constantly taking place in the distribution of stations.

[2] India. Meteorological Department. Climatological Atlas of India, published by the authority of the government of India under the direction of Sir John Eliot. Edinburgh, 1906.

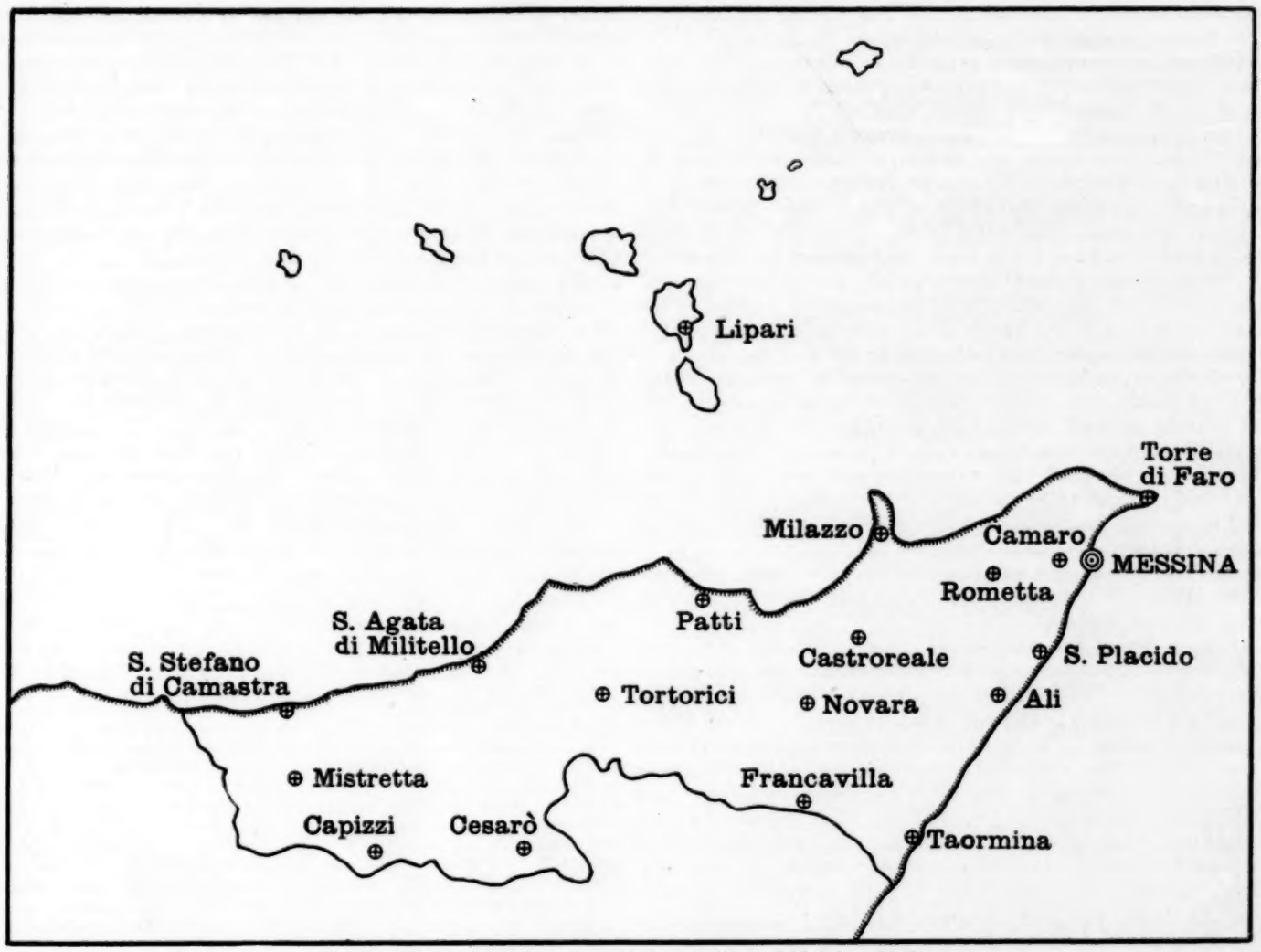

Fig. 1.—Climatological stations in the province of Messina, Sicily.

fleeting were the chances of observing, between the time when it was light enough to see and when the clouds covered the peaks in rising mist, that I only once had time to sketch the range, and once again to observe all the five peaks visible. On the five other occasions there was only time to observe the two highest points, while many a time, when the instrument had been placed in position and the telescope directed to the mountain, it was only to see the first cloud covering the coveted pinnacles. And all this in spite of a daily watch being kept at dawn to apprise me of even the possibility of seeing the mountain.

Mr. Douglas Freshfield, in the Alpine Journal for February and May, 1906, also bears witness to the meteorological difficulties in the way of an ascent of this mountain, which he vainly attempted last year.

The most favorable months for climbing are said by the natives to be January and July. This, of course, is due to the fact that, as Ruwenzori lies very near the equator, the equatorial rain belt is to the north of it in summer and to the south of it in winter, following the apparent movement of the sun.

Several rainfall stations have been established in the vicinity of Ruwenzori by the British authorities, and we shall soon know more about the meteorology of this interesting mountain.

RAINFALL OF THE BRITISH CENTRAL AFRICA PROTECTORATE (NYASALAND).

The Colonial Report for the British Central Africa Protectorate for the year 1904–5 (Colonial Reports—Annual. No. 472) contains statistics regarding the normal annual rainfall of that region. It appears that four distinct areas exist as to rainfall. Division No. 1, embracing the south and southeastern slopes of Mlanje, has an average yearly rainfall of 107.56 inches. Division No. 2, embracing the Shire Highlands from north Mlanje to Blantyre, Angoniland and west Nyasa up to Mombera's country, has an annual rainfall of 50.17 inches. Division No. 3, including the whole of the lower and upper Shire area from Port Herald to Fort Johnston, has a normal precipitation of 35.12 inches. Division No. 4, extending along west Nyasa from Nkata Bay northward to Kondowi, Nyika Plateau and Karonga, has a normal yearly rainfall of 76.54 inches.

Rainfall reports are now received at Zomba from 40 stations in the protectorate. Normal climatological stations (as the British call second order stations) exist at Fort Johnston, Zomba, Chinde, and Livingstonia. It was hoped to place barometers at Blantyre, on Zomba and Mlanje mountains, and one at Nkata Bay during 1905.

CLIMATOLOGICAL WORK IN NORTHERN NIGERIA.

From a meteorological point of view Northern Nigeria is one of the least known of the protectorates of the European powers in Africa. It is, therefore, gratifying to learn from a recent Colonial Report (Annual No. 476, Northern Nigeria Report for 1904) that meteorological stations have now been opened at every provincial headquarters in the protectorate. As Northern Nigeria is divided into 17 provinces, we take this to mean that 17 stations, widely distributed, are now furnishing climatological data, which will hereafter be summarized in the publications of the Colonial Office. The stations previously existing were Zungeru, Lokoja, and Yola.

The rainfall was very deficient in 1904, and in consequence the Niger was lower in the early part of 1905 than (it is said) had ever before been known in the memory of anyone.

PROFESSOR HENRY'S "CLIMATOLOGY OF THE UNITED STATES".[3]

In a paper entitled "A Climatological Dictionary for the United States", communicated to the Eighth International Geographic Congress, in 1904, Prof. A. J. Henry, of the United States Weather Bureau, announced that the Bureau was preparing for publication a volume of climatic statistics for the United States, embodying the principal data available from every State and Territory. No large, comprehensive work of this character, covering the whole of the United States, had been published since Blodget's "Climatology of the United States" (1857), Coffin's "Winds of the Northern Hemisphere" (1853) and "Winds of the Globe" (1876), and Schott's precipitation tables (2d ed., 1881) and temperature tables (1876).

This work is now in the hands of the printer, and is expected to appear about the middle of December, 1906.

Introductory chapters discuss the broader features of the climate, the latter term being used in the wide sense that includes typical as well as average weather, the cyclonic and anticyclonic control, and something of weather chronology—notable storms, hot and cold waves, dry and wet seasons, etc. This section extends to 84 pages, and is written in a style calculated to hold the attention of the general reader as well as the special student of climatology.

Pages 85–112 comprise summary tables of normal temperature, precipitation, humidity, sunshine, and wind for regular Weather Bureau stations.

The remainder of the work, which is not quite all in type at this writing, will be made up of the individual climatic tables for 686 stations. The stations are grouped by States, except that the New England States are treated together, as are Maryland and Delaware. The groups, therefore, correspond with the sections of the Climatological Service of the Weather Bureau, and the official in charge of each section contributes a sketch of the climate of his own district. The climatic data for each station occupy one page, and comprise uniformly a brief history and description of the station, a table of monthly, seasonal, and annual means, and a table giving the dates of abnormally high and low temperatures that have occurred during the period of observation.

The volume will contain about 1000 quarto pages, and upwards of thirty plates.

THE FIRST DAILY WEATHER MAPS FROM CHINA.

By C. FITZHUGH TALMAN, U. S. Weather Bureau.

Thanks to the public spirit of the great telegraph companies of the Far East, the observatories of Zi-ka-wei and Hongkong have for many years received daily meteorological telegrams, free of charge,[1] from a large number of points in China, Siberia, Japan, the Philippines, and Indo-China, and have thus been enabled to conduct a very successful storm-warning service, which is highly appreciated by the navigators of eastern seas. The approach of storms is announced by signal at a number of stations along the China coast, besides being communicated directly by telegraph to such masters of vessels as request the information. (The increasing extent to which this service is utilized is shown by the number of telegraphic requests for forecasts received at Zi-ka-wei Observatory from naval vessels alone, during three recent years; viz.: 1901, 75; 1902, 127; 1903, 184.)

In addition to its storm-warning service, Hongkong Observatory has long published a daily weather report, the "China Coast Meteorological Register", which gives in tabular form the observations made at the various reporting stations on the day of issue, together with a weather synopsis and a forecast.

It remained, however, for Zi-ka-wei Observatory to undertake the publication of a daily weather map for China. The first number of this publication is dated July 1, 1906.

This newest of daily weather maps consists of a printed base chart of eastern Asia, on which are stenciled isobars and wind arrows, while on the back of the chart appear the numerical returns of observations at the reporting stations and a synopsis of the weather conditions throughout the Far East. The size of the sheet is 9 by 11½ inches.

The accompanying chart (fig. 1) shows the location of all stations for which observations are tabulated. It will be seen that the field of observation embraces, in a general way, the whole of eastern Asia, including Japan and the Philippine Islands. The stations are, however, very unevenly distributed over this territory. Of the continental stations the great majority are situated along the coast and the Yangtze Valley. these being mostly stations of the Imperial Maritime Customs, located at the treaty ports. It is somewhat surprising that no reports are published from Korea, as excellent stations now exist in that country, under the direction of the meteorological service of Japan. Far to the northwest are the stations of Tomsk, Irkutsk, Troitskosavsk, and Chita, belonging to the Russian service, which is further represented by the stations at Vladivostok and Nikolaievsk, on the eastern seaboard. Japan, including Formosa, the Pescadores, etc., is represented by fourteen stations, while the Philippine Weather Bureau contributes reports from the three stations at Aparri, Legaspi, and Manila.

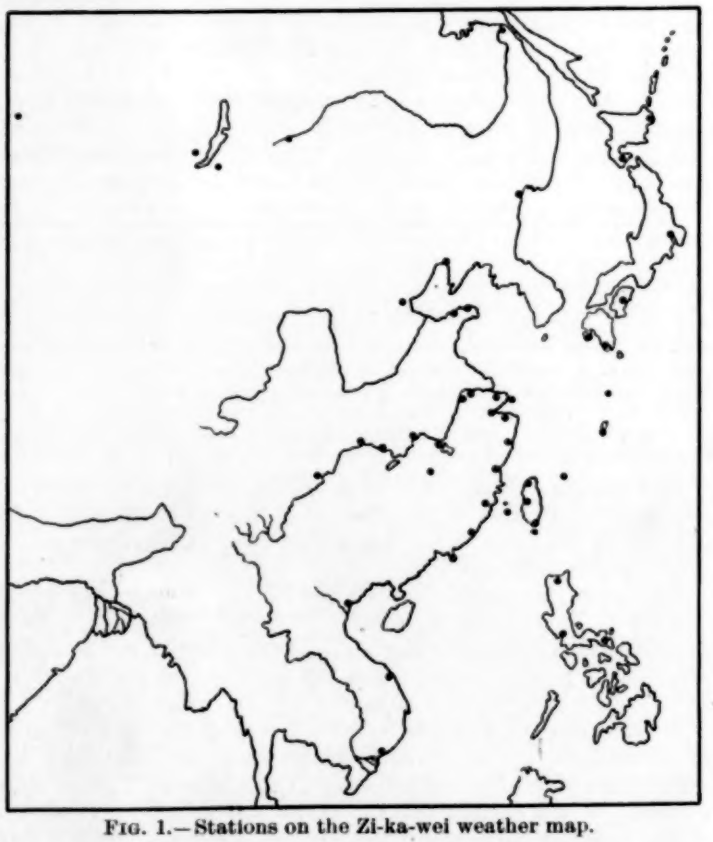

FIG. 1.—Stations on the Zi-ka-wei weather map.

In most of the inland provinces of China, and in the vast territories of Tibet, East Turkestan and Mongolia, meteorological work has hardly yet begun; hence these regions contribute nothing to the Chinese weather map. This lack of data from the west must be keenly felt by the forecasters of China, Japan, and the Philippines, as a majority of cyclonic disturbances on the China coast proceed from the interior of

[3] Henry, Alfred Judson. Climatology of the United States. Washington: Government Printing Office, 1906. (United States Weather Bureau. Bulletin Q.)

[1] In 1899 the director of Hongkong Observatory estimated that the telegrams furnished gratuitously to that observatory by the Eastern Extension and Great Northern Telegraph companies would, if paid for, amount to $250,000 a year. The entire amount allowed by the government for the maintenance of the observatory is only $7,500 a year.

the continent, especially during the winter months.[2] Typhoons, the chief object of the forecaster's solicitude in the Far East, reach China from the eastward, after traversing a region that is now fairly well under observation; but even these depressions must be largely conditioned, in their intensity, direction, and rate of progress, by fluctuations in the pressure to the west of the present field of observation.

WHAT IS RESEARCH?

The following excellent remarks, by the editor of the Experiment Station Record,[1] apply so well to meteorology that we take the liberty of quoting them, and inviting our readers to give us their own ideas as to what constitutes research.

The outlining of plans for agricultural work under the Adams act has led to greater consideration of what should be regarded as research in agriculture. The terms "research" and "investigation" have been used freely in reference to experiment station work, and often more broadly than they are employed in science generally. We have fallen into the habit of speaking of much of the work as investigation, which in a strict sense can not be regarded as of that grade. * * *

There are several reasons which contribute to this uncertainty in the use of terms. Agriculture is a new science. Our knowledge is not as well systematized and classified, and the problems for research are not so definitely outlined as they are in the older sciences. Being a composite science, it has been built up on the basis of the pure and natural sciences. It has drawn upon these for many facts, which have been given a scientific or a practical application in agriculture. Important as this application may be, it is not always to be regarded as research or scientific discovery. * * *

Again, the needs of agricultural practise have frequently blinded station workers, and led them to mistake for investigation, tests and demonstrations or simple experiments involving no original features, but which led to an answer to the farmer's question. They have been flooded with practical questions, and have set out to answer these questions in the most direct and quickest way. * * *

Hence it is that much of our experimental work has given results which are largely empirical. We find that if we follow a certain program of operations we will get a given result quite constantly. * * * The experimenter often sees only the final result, and is satisfied with this if it is favorable. The investigator will strive to determine the cause of what he sees and the broader bearings of the results of his experiments. This will stimulate him to make investigations into these problems which will go down to the fundamental facts and enable him to prove his proposition step by step.

These differences in the use of terms, which have grown up as a result of circumstances and environment, make it desirable that we should discriminate carefully and intelligently in applying the funds under a new act which restricts them to investigation. * * *

For example, there was much experimenting upon the use of lime for land. Applications to some soils gave beneficial results, while on others there appeared to be no benefit, and it was thought by some to exhaust the soil and to be ill advised. A few years ago this represented the status of knowledge and experimentation. The results and the practise were entirely empirical. The lime was usually not needed by the crops themselves, although it benefited them, but the purpose it served was not known, and there was no way of reasoning whether or not in a particular case lime would be helpful or its use advisable. Soil tests were relied upon for this purpose, and while they might be regarded as experiments, yet in themselves they did not comprise an investigation.

There were research problems which experience and these experiments had suggested, and after a while these problems became the subject of investigation. The effect of lime in correcting an acid condition of the soil was observed; the relations of this changed reaction to the biological factors of the soil were worked out; and gradually from these and other facts a basis was formed for the philosophy of liming. Through research the knowledge of this common practise had been made "accurate and precise", and this accuracy and precision had been "translated into action". * * *

In feeding work the case is often on much the same plane. For example, we make a comparison of wheat bran and gluten meal for milk production. One of these feeds gives the better result, as measured by the yield and the financial returns, but often the inquiry stops there. * * * The real physiological relation of these feeds, or of their respective constituents, to the elaboration of milk remains untouched by such experiments.

Suppose, again, we feed a lot of steers on heavy rations of corn for fattening. Humanity says: "Shelter them in a warm, comfortable barn". They appear after a little to resent this. They are uncomfortable, and it is difficult to keep them up to the high rations. Divide them into two lots, and turn one out into the cold with only a shed to shelter them from the winter winds. The latter lot does better—is more thrifty, eats better, and makes better gains. Is the question answered? Too often it stops here. We have the empirical result, but it is supported by no reason.

Put one of these heavily fed steers into a respiration calorimeter and we find he gives off heat enough under his heavy corn feeding to keep his body warm without artificial protection. The reason has been found. Again, knowledge of common things has been made accurate and precise, and may be translated into action. * * *

Research is worthy of the name only as it sets up definite ideals or aims which it strives to attain by scientific methods of procedure. This will involve a definite plan of operations, a thorough consideration of what is known of the subject and its bearings, both practical and scientific, and should lead the experimenter to learn something of the reasons for the results he secures. While the aim should remain fixed, the plan will often have to be modified in detail as the investigation progresses. But too often there appears to be lacking any well-thought-out plan or object; this is developed piecemeal and lacks in directness.

There are certain operations which will always be more or less experimental, as they will depend upon a variety of conditions, either indefinite in extent or combined in such a way as to make the outcome somewhat uncertain. Such operations can not proceed with mechanical exactness, and this very element of uncertainty will lend a charm to the work. But the object to be attained and the line of experiment should be matters of mature consideration. An investigation should presuppose this preliminary.

The line of demarcation between investigation and the lower grades of inquiry is not always clear and sharp, but the character of the problem does not determine this. The lowliest and the most common subject may be a proper matter for real investigation. It is the man in charge of the work and his mental attitude toward it which determines whether it shall be a simple test, a conclusive experiment, or a thorough investigation. If he has none of the scientific spirit or sees only the purely practical phase, his work will stop with comparisons and simple experiments; but if he has the true spirit of the investigator and is trained to observe, even though he may not have seen a college classroom, his results will contribute something toward establishing a scientific fact.

We have been accused in our experimental [agricultural] work of having the immediately practical results too constantly in mind. The immediately practical work is important and desirable. It has helped to make the American stations strong in the confidence of their constituents. It should be continued and the results carried to the farmer in demonstrations, cooperative experiments, and other popular ways. But it is equally important to get at the scientific facts, which have a wider and more permanent application. Surely there is no conflict between such investigation and the securing of practical results.

[1] Issue for June, 1906, pp. 929–933.

THE INTERNATIONAL SEISMOLOGICAL ASSOCIATION.

The United States of America, through the Secretary of State, lately indicated its willingness to take part in the above-mentioned international association for the study of the large earthquakes of the globe. This association has its central bureau at Strassburg, Germany, Professor Doctor G. Gerland being the director, and he submits the following circular for republication in the MONTHLY WEATHER REVIEW:

The Central Bureau of the International Seismological Association, founded in 1903 by the Second Seismological Conference, which met in Strassburg, is now completely organized and in full activity.

The central bureau is located in Strassburg (Alsace), Schwarzwaldstrasse 10; the undersigned has the honor to be its director; the personnel consists of two assistants, one mechanist, and one servant. The workrooms are on the second floor of the building, the first story being occupied by the Imperial German Central Station for Earthquake Investigation.

The Observatory of the Central Station, which is located near the Bureau, is furnished with the following instruments: (1) a Rebeur-Ehlert triple horizontal pendulum with photographic register; (2) a two component Rebeur pendulum with photographic register; (3) a Milne

[2] The relative number of storms reaching the China coast from the eastward and the westward is shown by the following statistics for the six years 1893–1898, as given by Father Froc in his "Atmosphere in the Far East during the six cold months" and "Atmosphere in the Far East during the six warm months." (Shanghai Meteorological Society. Seventh and eighth annual reports.)

	October.	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.	September.	Total.
Typhoons	21	9	4	0	0	2	2	7	10	27	15	18	115
Continental storms	13	23	26	23	27	34	32	29	20	8	5	9	249

pendulum; (4) the Wiechert pendulum, weighing 1000 kilometers, with a mechanical register; (5) the three-component microseismograph of Vicentini; (6) the Omori horizontal pendulum; (7) the Bosch horizontal pendulum (tromometer) weighing 100 kilograms; (8) the trifilar gravimeter of August Schmidt.

These instruments, which are all in active use, are giving accurate comparative observations; their seismograms, when carefully discussed, form a valuable collection.

The instruments and records of the central station are at the disposal of foreign visitors, especially citizens of the States associated in this work, who wish to use them for special study, with the restriction that the regular records of the instruments are to be undisturbed. The workrooms of the central bureau are open to foreign visitors for scientific, practical, or theoretical researches; the collection of seismograms of the central station may always be consulted by them.

In accordance with these provisions the geophysicist and seismologist, Doctor Pécsi, was sent by the Hungarian government to study at the central bureau for several weeks in order that he might make use of the records, with the assistance of the personnel of the central bureau and the central station. Professors Omori and Michailovitch intend to work at the central bureau for some time.

The principal work of the central bureau, as prescribed by its director, is at present directed toward the study of apparatus, and has for its object the enlargement of our knowledge of instruments and improvements in their use. Negotiations have been begun for the purpose of engaging a seismologist of great reputation to pursue extensive works of this nature at the central bureau with the apparatus of the central station.

These two institutions are distinct organizations, but their work is along parallel lines. The Imperial German Central Station places at the disposal of the Central Bureau of the International Seismological Association its instruments, its records, and in part its quarters; and on the other hand the central bureau, its rooms, and its personnel are of considerable service to the central station. Much work that is of great importance to the better understanding of the seismometry of our globe, which is the principal object of the Seismological Association, could only be carried on by the active cooperation of the two institutions, and work of all kinds is facilitated by this combined activity.

Literary works also are incumbent upon the central bureau; several have already been completed or are about to be; these works have as a basis the records and the researches of the central station. The central station is publishing at the present time, in the Beiträge zur Geophysik, a catalogue of all the microseismic earthquakes known to have occurred in eastern Asia; this catalogue, composed by Professor Rudolph, will be continued. The catalogue of earthquakes observed during the year 1903, begun by Rudolph (Beiträge zur Geophysik, Supplement III), will be continued for following years by the central bureau and a catalogue of all microseismic movements will be prepared.

In order that these works may be as complete as possible, the central bureau earnestly requests all delegates appointed by the cooperating nations to see that the most exact information regarding seismological observations in their respective countries be transmitted to the central bureau at the end of each half year, or better still, each quarter year. The most practical manner of attaining this object will be to send copies of all seismic perturbations of considerable importance registered by the different stations; they will be preserved at the central bureau and will be placed at the disposal of all who need them in their studies or researches.

The central bureau will also be much pleased to receive published works bearing on seismology, particularly investigations of different countries or of the entire globe. These works will form the nucleus of the future library of the central bureau.

ASTRONOMY *versus* METEOROLOGY.

The Astronomical Association, organized in 1865 in Germany, and the Royal Astronomical Society of London, organized in 1820, publish annually condensed reports of the work done by the more prominent astronomical observatories in the world. The last number of the Notices of the London society and the last Vierteljahrschrift of the German society give such reports from 27 English and 39 continental institutions, respectively. Although astronomy is the prime work of all of these, and although some of them necessarily pay special attention to atmospheric conditions, in so far as they affect astronomical work, yet only a few maintain regular meteorological observations comparable with those of our regular stations. Nevertheless the fact that 13 out of the 27 English, and 10 out of the 39 continental observatories do maintain such series is an interesting evidence of the intimate relation between the two branches of science. In many of these cases the meteorological record is continued by the observer as a pious duty, in view of its having been begun many years ago when the astronomer was the accurate observer of all geophysical phenomena, and when men looked to him for information with regard to earthquakes, terrestrial magnetism, and the weather, as well as the stars. In recent years each of these has become a special branch of science, requiring a special building and instruments. It is, however, very fortunate for meteorology that the astronomer, with his accurate instruments, can frequently give measurements from which meteorologists derive great benefit. Very few of the latter have at hand apparatus for determining the exact angular dimensions of halos, the absorption bands due to the air and the vapor, the exact location of a meteor train, the altitude and azimuth of the twilight arc, the degree of polarization of the skylight, or the ordinary phenomena of refraction and the extraordinary refractions of the mirage. For information on these and other points we generally depend on the astronomer, or some individual physicist; but it is to be hoped that we may eventually have many meteorological institutions where these matters are properly attended to. The so-called regular observations, that have been made since the days of Ferdinand II, the Grand Duke of Tuscany, who organized the first system of stations in 1653, certainly need to be supplemented by observations in every field that modern science has opened up to meteorological research.—*C. A.*

RECENT PAPERS BEARING ON METEOROLOGY.

H. H. KIMBALL, Librarian.

The subjoined titles have been selected from the contents of the periodicals and serials recently received in the Library of the Weather Bureau. The titles selected are of papers or other communications bearing on meteorology or cognate branches of science. This is not a complete index of the meteorological contents of all the journals from which it has been compiled; it shows only the articles that appear to the compiler likely to be of particular interest in connection with the work of the Weather Bureau. Unsigned articles are indicated by a ——

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Angot, Alfred. Régime pluviométrique de la Méditerranée. II. Tripolitaine. Pp. 119–122.

Goutereau, Ch. Sur la variabilité de la température. Pp. 122–127.

Marchand, E. L'électricité atmosphérique au Pic du Midi (2860 m.). Pp. 137–146.

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Nell, Chr. A. C. Périodicité des bandes polaires. Pp. 59–61.
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Riggenbach, A[lbert]. Die tägliche Periode des Niederschlages in Basel. Pp. 276–279.
Bezold, Wilhelm von. Ueber Strahlungsnormalen und Mittellinien der Temperatur. Pp. 279–287.
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RECENT ADDITIONS TO THE WEATHER BUREAU LIBRARY.

By H. H. KIMBALL, Librarian.

The following titles have been selected from among the books recently received, as representing those most likely to be useful to Weather Bureau officials in their meteorological work and studies. Most of them can be loaned for a limited time to officials and employees who make application for them.

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FORECASTS AND WARNINGS.

By Prof. E. B. GARRIOTT, in charge of Forecast Division.

Barometric disturbances crossed the British Isles during the first, second, and third decades of the month, those of the first and second decades being of marked intensity. In the vicinity of the Azores high barometric pressure prevailed, except on the 21st and 22d and from the 27th to 31st, the lowest reported reading of the month, 29.60 inches, being noted on the 30th. Over the western Atlantic the weather was as a rule quiet. A tropical disturbance that appeared east of Barbados August 31, moved thence on a northwesterly course to the northern Bahamas by September 7, and there recurved northeastward will be discussed in the September REVIEW.

No severe wind storms visited the sea coasts and Great

Lakes of the United States. An unusual number of barometric depressions moved southeastward from the British Northwest Territory over the Missouri Valley and the Lake region, and passed thence eastward attended by local rains and thunderstorms. Persistent and heavy rains in the Middle-Eastern and Southeastern States, and dry warm weather in New England and parts of New York were notable features of the month. From the 26th to 28th a frost-bearing cool wave, for which warnings were issued, overspread the Northwestern States and the extreme upper Mississippi Valley.

BOSTON FORECAST DISTRICT.

The month was exceptionally warm and dry. On the 6th severe thunderstorms occurred in western Massachusetts and parts of New Hampshire, and on the 21st in western Massachusetts. No storm warnings were ordered and no high winds occurred on the coast.—*J. W. Smith, District Forecaster.*

NEW ORLEANS FORECAST DISTRICT.

Precipitation was unevenly distributed, being excessive in some districts and deficient in others. Temperature changes were slight. Special warnings were not issued or required.—*I. M. Cline, District Forecaster.*

LOUISVILLE FORECAST DISTRICT.

Sluggish barometric conditions prevailed. Showers were frequent and there were some heavy local rains. Though no very high temperatures occurred, humid and warm weather prevailed until the 27th, when cooler weather set in. No special warnings were issued and none were required.—*G. B. Wurtz, Local Forecaster.*

CHICAGO FORECAST DISTRICT.

The month was generally uneventful. From the 26th to 28th frost warnings were issued for frosts that occurred at points in Nebraska and northern Iowa on the 27th and in the cranberry districts of Wisconsin on the 27th and 28th.—*H. C. Frankenfield, Professor and District Forecaster.*

DENVER FORECAST DISTRICT.

The month was cooler than usual with the greatest deficiency of temperature in southern portions of New Mexico and Arizona. Less than the usual amount of rain fell in Colorado and adjacent parts of Wyoming and New Mexico, while in western Wyoming, Utah, Arizona, and southern New Mexico the rainfall was abnormally heavy and at a number of stations exceeded all previous records for August. No special warnings were issued or required.—*F. H. Brandenburg, District Forecaster.*

SAN FRANCISCO FORECAST DISTRICT.

The month, as a whole, was a quiet one. There were thunderstorms with resulting washouts in the Salton and Colorado deserts during the first and second decades of the month. On the 11th showers were general in Nevada and the Sierra Madre. On the 18th heavy rains occurred in the valley of the Colorado and numerous thunderstorms in Nevada. Showers were general in southern California and Nevada on the 20th and 21st.—*A. G. McAdie, Professor and District Forecaster.*

PORTLAND, OREG., FORECAST DISTRICT.

The month was quiet and no special warnings were issued or required. The temperature averaged slightly above normal and precipitation was deficient, except in a few localities, where heavy local rains occurred. Owing to the dry weather there were numerous forset fires, which destroyed a large amount of property. The dry weather also resulted in unusually low stages in the rivers.—*E. A. Beals, District Forecaster.*

RIVERS AND FLOODS.

With the exception of the rivers of North Carolina, South Carolina, and Texas, and the lower portion of the Arkansas River, there were no high stages during the month.

The Mississippi River was highest during the first of the month in the lower, and the last of the month in the upper portion.

The Ohio and Missouri rivers were highest during the middle of the month, due to the general rains of that period. The rivers of the Carolinas were also affected by these rains, which caused high water, and the additional precipitation during the last of the month over the watersheds of these rivers caused flood stages on the Roanoke, Cape Fear, Pedee, Catawba, Wateree, Broad, and Saluda rivers, especially in the lower portions. The warnings were issued for the high water well in advance, and were, in nearly all instances, fully verified.

Unusually heavy local rains over the headwaters of the Colorado and Trinity rivers of Texas caused rapid rises of those streams. The Trinity reached flood stages on its upper portion only, while the Colorado overflowed over its entire length. Warnings were issued on August 7, for the floods of the 12th to the 15th in the lower Colorado River.

On August 9 and 10, warnings were issued for high water in the Arkansas, although flood stages were not expected. These warnings were fully justified.

The Columbia and its tributaries fell slowly throughout the month.

The highest and lowest water, mean stage, and monthly range at 268 river stations are given in Table VI. Hydrographs for typical points on seven principal rivers are shown on Chart I. The stations selected for charting are Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.

THE WEATHER OF THE MONTH.

By Mr. P. C. DAY, Assistant Chief, Division of Meteorological Records.

PRESSURE.

The distribution of mean atmospheric pressure is graphically shown on Chart VI, and the average values and departures from the normal are shown in Tables I and V.

No marked variations from the normal occurred in the distribution of the average pressure during the month.

The areas of low pressure originated mainly over the Canadian northwest, moved southeast over the Missouri Valley, recurved northeastward to the Lakes, and passed eastward north of the St. Lawrence Valley.

The areas of high pressure, as a rule, also passed eastward north of the boundary.

As a result of the unusual northern paths of the highs and lows, the greater part of the territory of the United States was not within the influence of any marked atmospheric disturbance during the month. Stagnant atmospheric conditions prevailed and any marked variation from the normal of the several elements was due in the main to local conditions.

Pressure was slightly below normal in the Lake region, Ohio, upper Mississippi, and lower Missouri valleys, and generally west of the Rocky Mountains, except over northwest Washington. It was slightly above normal over the Atlantic and Gulf States, Texas, and the Plains region.

TEMPERATURE.

Average temperatures above the normal prevailed over all districts of the United States and Canada, except over western Texas, the Rocky Mountain and eastern Plateau sections, southern California, and the coast of Washington.

Nearly continuous warm weather prevailed over the Lake region and eastward over New York and New England, where

the monthly averages exceeded the normal from 2° to 5° per day, and at a number of points they were the highest ever recorded in August.

Over the Ohio and upper Mississippi valleys, the Middle Atlantic and east Gulf States, temperatures were well above the average, due in the main to the humid conditions of the atmosphere preventing radiation at night, with resulting minimum temperatures uniformly higher than the average. Over western Texas and the southern Rocky Mountain region the month was uniformly cool. No periods of excessive heat occurred, except over eastern Montana and North Dakota, where maximum temperatures above 100° were of frequent occurrence from the 11th to the 18th; and over the New England States, where temperatures as high as any previously recorded in August were observed on the 19th.

The usual high temperatures, ranging from 100° to 110°, or more, were recorded in southwestern Arizona and southeastern California.

Freezing temperature and killing frosts occurred at the higher elevations in the mountain districts and in the northern portions of North Dakota and Minnesota.

PRECIPITATION.

The precipitation during August, while generally abundant for the needs of growing vegetation, was very unevenly distributed as to the total fall, due largely to the local character of the storms. As the general atmospheric disturbances were confined, in the main, to the Lake region and upper Mississippi and Missouri valleys, the precipitation over other sections of the country came largely from local thunderstorms. The irregular distribution of the rainfall is graphically shown on the chart of monthly precipitation, where areas of marked excess appear, while nearby sections frequently show corresponding deficiencies. Over large sections of the Middle Atlantic States, the Mississippi and Missouri valleys, northwestern Texas, Oklahoma, and the southern Rocky Mountain section, the precipitation was heavy and persistent. Over sections of Maryland and Virginia the total fall was the highest on record for the month; and at Washington, D. C., the amount measured, 14.36 inches, was the greatest recorded in any month during a period of nearly seventy-five years of reliable observation. Especially heavy rains prevailed over the central portion of western Maryland on the 2d, where amounts from five to nearly nine inches were recorded in periods of twenty-four hours or less. In parts of western Texas, central Oklahoma, southeastern South Dakota, and the southern parts of Arizona and New Mexico the precipitation was in excess of the record for any previous August. Over practically the whole of Arizona and New Mexico, and portions of Colorado, Utah, and Nevada, the precipitation was generally well distributed during the entire month, and the run-off from the heavy falls added large volumes to all streams in that section, and a plentiful supply of water was available for all purposes.

Throughout nearly all sections where precipitation normally prevails during August the fall was well distributed during the several periods of the month and no serious lack of moisture was experienced by growing vegetation. Small sections over the Gulf coast received extremely small total amounts of precipitation and there was a general deficiency in the monthly amounts over most of New England and the northwest coast of Washington.

HUMIDITY AND CLOUDINESS.

The humidity was in excess of the normal in nearly all districts as was also the average cloudiness.

The excessive amount of moisture, the preponderance of cloudy and rainy days, and the general stagnant condition of the atmosphere, as shown by the decreased wind movement, made the weather for the month, as a whole, mentally depressing and physically enervating.

In Canada.—Prof. R. F. Stupart says:

The mean temperature of the month was higher than the average over the larger portion of the Dominion, districts near the coast and in northern British Columbia alone showing a temperature lower than the average. The highest positive departures, from 4° to 5°, occurred in the more central parts of Ontario and New Brunswick, while in the St. Lawrence Valley, the excess of the average was about 3°, and in the Northwest Provinces it was very generally between 1° and 2°.

In Canada.—Professor Stupart says:

The rainfall was less than the average over the greater part of the Dominion, portions of Ontario lying east and south of the Georgian Bay and immediately north of Lake Erie, together with the more southern portions of Alberta, alone showing a small excess, and even in these districts the larger fall was due to a few local thunderstorms. In the more northern parts of the Northwest Provinces and in British Columbia it was particularly scant, being very generally less than an inch; and in the Ottawa and upper St. Lawrence Valleys it was for the most part between one and two inches.

Average temperatures and departures from the normal.

Districts.	Number of stations.	Average temperatures for the current month.	Departures for the current month.	Accumulated departures since January 1.	Average departures since January 1.
		°	°	°	°
New England	9	69.8	+ 2.3	+ 5.5	+ 0.7
Middle Atlantic	13	76.0	+ 2.6	+ 7.9	+ 1.0
South Atlantic	10	80.0	+ 2.1	+ 1.0	+ 0.1
Florida Peninsula*	8	81.3	— 0.1	— 1.1	— 0.1
East Gulf	8	80.9	+ 1.4	— 6.6	— 0.8
West Gulf	7	80.8	— 0.2	— 4.2	— 0.5
Ohio Valley and Tennessee	12	77.2	+ 2.7	0.0	0.0
Lower Lake	8	73.2	+ 3.8	+ 9.5	+ 1.2
Upper Lake	10	69.8	+ 3.7	+13.7	+ 1.7
North Dakota*	8	66.6	+ 0.5	+14.6	+ 1.8
Upper Mississippi Valley	13	74.6	+ 2.2	+ 3.0	+ 3.4
Missouri Valley	11	74.1	+ 1.1	+ 7.7	+ 1.0
Northern Slope	7	67.3	— 0.5	+ 6.7	+ 0.8
Middle Slope	6	74.8	+ 0.2	+ 1.0	+ 0.1
Southern Slope*	6	76.3	— 2.0	— 9.1	— 1.1
Southern Plateau*	13	74.8	— 1.9	+ 0.7	+ 0.1
Middle Plateau*	8	69.2	— 0.8	0.0	0.0
Northern Plateau*	12	68.7	+ 0.2	+12.5	+ 1.6
North Pacific	7	61.9	+ 0.5	+11.1	+ 1.4
Middle Pacific	5	64.2	— 0.4	+ 9.4	+ 1.2
South Pacific	4	71.4	0.0	+ 6.0	+ 0.8

* Regular Weather Bureau and selected cooperative stations.

Average precipitation and departures from the normal.

Districts.	Number of stations.	Average.		Departure.	
		Current month.	Percentage of normal.	Current month.	Accumulated since Jan. 1.
		Inches.		*Inches.*	*Inches.*
New England	9	2.40	63	—1.4	—0.4
Middle Atlantic	13	7.57	166	+3.0	+2.5
South Atlantic	10	6.21	97	—0.2	0.0
Florida Peninsula*	8	8.02	116	+1.1	+9.0
East Gulf	8	4.77	87	—0.7	—4.3
West Gulf	7	3.07	91	—0.3	—6.6
Ohio Valley and Tennessee	12	3.58	103	+0.1	—5.4
Lower Lake	8	3.42	121	+0.6	—3.5
Upper Lake	10	3.01	103	+0.1	—2.1
North Dakota*	8	2.08	117	+0.3	+2.1
Upper Mississippi Valley	13	4.42	147	+1.4	—1.2
Missouri Valley	11	5.12	170	+2.1	—0.6
Northern Slope	7	2.63	198	+1.3	+1.5
Middle Slope	6	3.33	137	+0.9	—0.5
Southern Slope*	6	5.08	213	+2.7	+3.2
Southern Plateau*	13	2.24	145	+0.7	+2.9
Middle Plateau*	8	1.26	147	+0.4	+4.0
Northern Plateau*	12	0.85	189	+0.4	+0.1
North Pacific	7	0.20	22	—0.7	—8.3
Middle Pacific	5	0.02	17	—0.1	+4.5
South Pacific	4	0.04	100	0.0	+6.4

* Regular Weather Bureau and selected cooperative stations.

Maximum wind velocities.

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
Amarillo, Tex	7	50	se.	Mount Tamalpais, Cal.	21	50	sw.
Havre, Mont	13	56	sw.	Point Reyes Light, Cal.	12	60	nw.
Mount Tamalpais, Cal.	12	54	nw.	Sand Key, Fla	4	54	s.

Average relative humidity and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
	%			%	
New England	82	0	Missouri Valley	74	+ 7
Middle Atlantic	84	+ 8	Northern Slope	63	+11
South Atlantic	86	+ 4	Middle Slope	68	+10
Florida Peninsula	82	+ 2	Southern Slope	72	+11
East Gulf	82	+ 2	Southern Plateau	54	+12
West Gulf	79	+ 4	Middle Plateau	46	+10
Ohio Valley and Tennessee	79	+ 7	Northern Plateau	42	— 2
Lower Lake	75	+ 4	North Pacific	74	— 5
Upper Lake	78	+ 3	Middle Pacific	63	+ 1
North Dakota	74	+10	South Pacific	68	+ 2
Upper Mississippi Valley	77	+ 7			

Average cloudiness and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England	4.8	— 0.2	Missouri Valley	4.7	+ 0.6
Middle Atlantic	6.4	+ 1.4	Northern Slope	4.0	+ 0.3
South Atlantic	6.0	+ 0.8	Middle Slope	4.2	+ 0.4
Florida Peninsula	5.4	+ 0.2	Southern Slope	4.8	0.0
East Gulf	5.4	+ 0.5	Southern Plateau	3.8	+ 0.4
West Gulf	4.6	+ 0.2	Middle Plateau	3.6	+ 1.4
Ohio Valley and Tennessee	5.6	+ 1.1	Northern Plateau	3.1	+ 0.1
Lower Lake	4.4	— 0.1	North Pacific	4.4	+ 0.5
Upper Lake	4.8	0.0	Middle Pacific	4.0	+ 1.2
North Dakota	4.8	+ 0.9	South Pacific	2.6	+ 0.1
Upper Mississippi Valley	4.8	+ 0.7			

CLIMATOLOGICAL SUMMARY.

By Mr. JAMES BERRY, Chief of the Climatological Division.

TEMPERATURE AND PRECIPITATION BY SECTIONS, AUGUST, 1906.

In the following table are given, for the various sections of the Climatological Service of the Weather Bureau, the average temperature and rainfall, the stations reporting the highest and lowest temperatures with dates of occurrence, the stations reporting greatest and least monthly precipitation, and other data, as indicated by the several headings.

The mean temperatures for each section, the highest and lowest temperatures, the average precipitation, and the greatest and least monthly amounts are found by using all trustworthy records available.

The mean departures from normal temperature and precipitation are based only on records from stations that have ten or more years of observation. Of course the number of such records is smaller than the total number of stations.

Section.	Temperature—in degrees Fahrenheit.							Precipitation—in inches and hundredths.					
	Section average.	Departure from the normal.	Monthly extremes.					Section average.	Departure from the normal.	Greatest monthly.		Least monthly.	
			Station.	Highest.	Date.	Station.	Lowest. Date.			Station.	Amount.	Station.	Amount.
Alabama	80.4	+ 0.9	Newberne	102	25	Riverton	55 28,30	3.78	—0.92	Oneonto	11.23	Selma	0.66
Arizona	77.4	— 2.7	Casagrande	117	6	Quaklingasp	33 24-26	3.52	+1.26	Oracle	7.91	Sentinel	0.53
Arkansas	77.9	— 1.4	Jonesboro, Warren.	100	19	Harrison	42 28	4.92	+1.04	Arnett	11.41	Cornerstone	0.50
California	73.6	+ 0.6	Mammoth Tank	124	12	Tamarack	34 24	0.13	+0.03	Needles	5.66	Many stations	0.00
Colorado	64.2	— 1.2	Las Animas	106	21	Antelope Springs	25 26	1.91	—0.05	Sugar City	4.90	Blaine	0.12
Florida	81.4	— 0.1	Madison	100	9,10	Molino	62 4	7.20	+2.20	Tarpon Springs	20.99	Pensacola	1.61
Georgia	80.1	+ 0.9	Brunswick Fitzgerald	102 102	9,10 11	Diamond	59 1	5.82	+0.13	Glennville	12.81	Valdosta	1.49
Hawaii	†74.8	.....	Kihei, Maui	95	7	Humuula, Hawaii	39 2,3	‡8.87	.....	Honomanu V., Maui	34.99	Waiopae ranch, Maui	0.00
Idaho	66.6	— 0.3	Cambridge Lewiston	107 107	10 11	Chesterfield	25 25	0.97	+0.54	Weston	3.86	Pearl	T.
Illinois	76.3	+ 2.4	Cisne Mount Vernon	101 101	12 4	Kishwaukee	39 28	4.01	+0.85	Palestine	9.97	Pontiac	0.80
Indiana	76.1	+ 2.7	5 stations	98	4 dates	3 stations	43 28	4.68	+1.81	Marion	9.66	Syracuse	2.04
Iowa	74.1	+ 2.1	Odebolt	101	16	Washta	33 27	3.95	+0.38	Sibley	10.51	Allerton	0.92
Kansas	76.3	— 0.7	Coolidge	105	22	Hays	36 27	3.98	+1.04	Baker	10.91	Lebanon	T.
Kentucky	77.4	+ 1.4	Maysville	99	24	Earlington	45 28	4.37	+0.98	Falmouth	8.96	Louisville	1.92
Louisiana	82.1	+ 0.6	Alexandria	105	22	5 stations	52 27-29	2.92	—2.09	Pearl River	8.02	St. Francisville	0.25
Maryland and Delaware	75.8	+ 1.8	Milford, Del	97	7	Deer Park, Md	47 15	8.44	+4.51	Washington, D. C	14.36	Oakland, Md	2.98
Michigan	70.3	+ 4.4	3 stations	96	4 dates	Humboldt	31 31	2.93	—0.01	Marlboro	9.40	Traverse City	0.82
Minnesota	68.7	+ 1.4	Lynd, Rouse	102	17	International Falls	27 31	4.66	+1.47	Park Rapids	10.13	International Falls	0.53
Mississippi	80.6	+ 0.4	5 stations	101	6 dates	Ripley	51 29	3.00	—1.58	Meridian	8.95	Jackson	0.75
Missouri	76.6	+ 0.3	Princeton	101	16	3 stations	40 27,28	4.72	+0.53	Warsaw	12.43	Nevada	1.28
Montana	64.3	— 0.8	Plentywood	108	15	Grayling	23 26,30	2.25	+1.20	Tokna	4.07	Plentywood	0.12
Nebraska	72.5	— 0.3	Lynch, Santee	104	16	Agate Winnebago	36 26 36 27	3.66	+0.62	Hartington	10.75	Guide Rock	0.95
Nevada	70.1	0.0	Logan	111	15	Wells	26 25	0.82	+0.12	Geyser	4.93	4 stations	0.00
New England*	70.0	+ 2.7	Millinocket, Me	102	19	Woodstock, Vt	33 17	2.68	—1.24	Mount Tom, Mass	8.01	Franklin Falls, N.H	0.56
New Jersey	74.6	+ 2.4	Indian Mills	97	6	Charlotteburg	42 16	5.95	+1.11	Toms River	17.91	Bergen Point	2.21
New Mexico	68.7	— 1.9	San Marcial	105	1	Red River	31 16,29	2.32	+0.33	Elk	6.64	Rosa	0.30
New York	70.6	+ 3.7	Elmira	100	23	Indian Lake	30 15	3.44	—0.04	Angelica	8.33	Appleton	1.44
North Carolina	78.2	+ 2.1	Moncure, Selma	98	11	Pink Beds	50 8	9.26	+2.91	Henderson	16.00	Asheville	3.89
North Dakota	66.2	+ 0.4	Ellendale	107	19	Lakota	31 31	1.90	+0.41	Donnybrook	3.30	Walhalla	0.34
Ohio	74.6	+ 3.1	Findlay	101	21	Green Hill	43 28	4.72	+1.73	Fremont	9.51	Bangorville	1.96
Oklahoma and Indian Territories	77.6	— 3.1	Temple, Okla	101	16,30	Beaver, Okla	41 27	6.57	+3.53	Holdenville, Ind. T	14.85	Kenton, Okla	1.16
Oregon	67.0	+ 1.5	Beulah	108	4	Granite Silver Lake	28 19,20 28 21	0.24	—0.36	Joseph	1.03	15 stations	0.00
Pennsylvania	73.2	+ 3.0	Freeport	96	6	Pocono Lake	39 17	5.62	+1.72	Philadelphia (c)	11.65	Wilkes-Barre	1.62
Porto Rico	79.5	.....	San Lorenzo	103	22	Corozal	53 13	5.98	.....	Las Marias	20.35	Santa Isabel	0.02
South Carolina	80.6	+ 1.2	3 stations	100	7,10	Trenton	60 1	6.62	+0.63	Spartanburg	12.45	Allendale	2.00
South Dakota	69.9	— 0.3	Ashcroft Orman	106 106	16,18 17	Little Eagle	36 26,27	5.41	+3.34	Plankinton	10.20	Spearfish	1.63
Tennessee	77.5	+ 1.1	Cedar Hill	101	21	Bolivar	50 30	4.28	+0.45	Elizabethton	8.12	Center Point	1.28
Texas	80.0	— 1.8	Tilden	104	7	Rhineland	40 28	3.54	+1.56	Ballinger	12.54	Athens	0.50
Utah	68.9	— 0.7	Fillmore Thistle	105 105	10 5	Coyoto	29 28	2.09	+1.25	Morgan	4.57	Indianola	0.30
Virginia	76.2	+ 1.9	3 stations	98	6,7,9	Hot Springs	50 31	9.51	+5.34	Callaville	16.75	Lynchburg	4.84
Washington	66.3	+ 0.6	Mottingers Ranch	108	10	Northport	30 20	0.34	—0.36	Zindel	1.85	2 stations	0.00
West Virginia	75.4	+ 2.5	Sutton	98	6	New Cumberland	47 28	5.15	+0.99	Pickens	10.72	Cuba	2.18
Wisconsin	70.4	+ 2.8	Amherst, Neillsville	98	20	Prentice	32 31	4.07	+0.68	Brodhead	8.55	Menasha	1.37
Wyoming	62.1	— 0.6	Alcova	105	17	Snake River, Y.N.P.	20 27	1.97	+0.66	Story	4.94	Cheyenne (ex. farm)	0.47

* Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut. † 50 stations, with an average elevation of 767 feet. ‡ 147 stations.

DESCRIPTION OF TABLES AND CHARTS.

By Mr. P. C. DAY, Assistant Chief, Division of Meteorological Records.

For description of tables and charts see page 38 of REVIEW for January, 1906.

TABLE I.—*Climatological data for U. S. Weather Bureau stations, August, 1906.*

Stations.	Elevation of instruments.			Pressure, in inches.			Temperature of the air, in degrees Fahrenheit.										Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches.			Wind.					Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness during daylight, tenths.	Total snowfall.
	Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Mean max. + mean min. ÷ 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.				Total.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Maximum velocity. Miles per hour.	Maximum velocity. Direction.	Maximum velocity. Date.					
New England.							69.8	+ 2.3								82	2.40	— 1.4											4.8	
Eastport	76	69	85	29.90	29.98	+ .02	63.2	+ 2.6	85	7	72	49	30	54	31	58	55	79	1.79	— 1.7	8	5,608	s.	25	w.	31	12	15	4	4.5	
Portland, Me.	108	81	117	29.89	30.01	+ .03	69.1	+ 2.3	93	23	78	52	15	61	33	63	60	77	1.73	— 2.0	6	5,710	s.	40	nw.	6	13	10	8	4.5	
Concord	288	70	79	29.71	30.01	+ .03	70.1	+ 2.6	93	19	81	47	16	59	35	....	....	....	2.24	— 1.4	7	2,910	se.	29	nw.	23	18	11	2	2.8	
Burlington	404	12	47	29.58	30.01	+ .04	69.0	+ 0.3	89	19	79	44	13	59	32	....	....	....	2.26	— 1.9	9	6,781	s.	30	s.	26	18	3	10	4.2	
Northfield	876	16	70	29.10	30.03	+ .05	65.8	+ 2.9	90	19	78	39	13	58	40	62	60	84	3.55	— 0.4	6	4,702	s.	32	nw.	6	12	14	5	4.3	
Boston	125	115	188	29.89	30.02	+ .03	72.0	+ 2.9	93	6	79	57	15	65	26	66	64	78	1.58	— 2.8	7	6,000	sw.	28	sw.	27	11	9	11	5.8	
Nantucket	12	14	90	30.01	30.02	+ .03	69.5	+ 1.8	83	7	76	56	25	63	21	66	65	90	6.93	+ 3.8	10	9,343	sw.	38	ne.	24	11	12	8	5.3	
Block Island	26	11	46	30.00	30.03	+ .04	70.5	+ 2.5	83	7	75	60	16	66	15	67	66	90	1.84	— 1.6	9	9,524	sw.	33	ne.	24	13	12	6	4.7	
Narragansett	....	9	....	....	....	....	70.4	+ 2.0	88	12	77	52	16	64	24	....	....	....	0.91	— 2.3	11	....	w.	....	....	....	21	2	8	....	
Providence	160	57	67	29.86	30.03	+ .04	72.2	+ 1.4	91	6	81	53	25	64	24	66	64	81	2.51	.....	9	3,851	sw.	19	nw.	31	8	15	8	5.1	
Hartford	159	122	132	29.85	30.02	+ .03	72.8	+ 2.9	93	6	82	51	25	64	28	66	64	78	2.65	.....	11	4,374	s.	27	sw.	27	7	12	12	6.3	
New Haven	106	116	155	29.91	30.02	+ .03	73.1	+ 3.1	92	6	81	55	25	65	24	68	65	81	1.13	— 4.0	8	5,558	s.	24	ne.	24	9	14	8	5.2	
Mid. Atlantic States.							76.0	+ 2.6								84	7.57	+ 3.0											6.4	
Albany	97	102	115	29.91	30.01	+ .03	73.3	+ 2.8	91	6	83	53	16	63	28	66	63	76	2.49	— 1.6	8	4,535	s.	26	n.	23	11	11	9	5.1	
Binghamton	875	79	90	29.11	30.02	+ .03	71.2	+ 3.8	92	5	81	44	16	61	36	....	....	....	4.62	+ 0.9	10	2,937	e.	31	nw.	7	7	10	14	6.2	
New York	314	108	350	29.69	30.01	+ .01	75.3	+ 3.0	93	6	81	63	25	69	19	69	67	79	3.68	— 1.0	11	6,443	s.	36	ne.	24	6	11	14	6.5	
Harrisburg	374	94	104	29.63	30.02	+ .01	74.7	+ 2.6	90	6	82	61	25	68	22	69	67	81	5.39	+ 0.9	12	3,792	e.	38	nw.	6	5	12	14	6.7	
Philadelphia	117	116	184	29.90	30.02	+ .02	76.2	+ 2.4	94	6	82	63	25	70	19	70	68	80	9.56	+ 5.2	15	6,160	sw.	44	ne.	21	5	9	17	7.3	
Scranton	805	111	119	29.17	30.02	+ .02	72.8	.....	92	5	82	49	16	64	34	66	63	76	1.76	.....	11	4,262	sw.	25	nw.	23	7	14	10	5.6	
Atlantic City	52	37	48	29.97	30.02	+ .02	75.6	+ 3.8	88	6	80	66	24	71	17	71	70	85	8.35	+ 3.6	15	5,357	sw.	20	sw.	27	2	13	16	7.3	
Cape May	17	48	52	30.02	30.03	+ .03	75.7	+ 2.8	86	6	79	67	29	72	13	72	....	....	4.15	— 0.6	14	5,010	s.	....	.....	....	5	19	7	6.0	
Baltimore	123	69	117	29.88	30.00	— .01	76.8	+ 1.9	96	6	84	63	13	70	20	71	69	82	5.80	+ 1.8	16	4,338	sw.	24	se.	21	2	9	20	7.7	
Washington	112	59	76	29.89	30.01	.00	76.4	+ 1.8	94	6	84	62	28	69	22	72	70	88	14.36	+10.4	16	3,373	s.	37	nw.	21	5	14	12	7.0	
Cape Henry	18	11	58	30.00	30.02	+ .02	79.2	+ 2.8	95	7	87	70	11	73	22	....	....	....	15.85	+10.3	18	7,371	s.	40	n.	7	5	16	10	6.0	
Lynchburg	681	83	88	29.29	30.02	.00	77.5	+ 2.2	92	7	85	63	29	70	22	72	71	88	4.84	+ 0.8	18	2,070	ne.	18	w.	7	5	15	11	6.1	
Mount Weather	1,725	10	57	28.26	30.02	+ .01	70.6	.....	86	6	77	58	28	65	18	67	66	91	9.32	.....	20	7,526	se.	40	nw.	27	3	15	13	6.9	
Norfolk	91	102	111	29.92	30.02	+ .02	79.6	+ 3.0	93	7	86	70	13	73	20	74	73	86	11.20	+ 5.1	19	5,454	s.	31	s.	11	2	15	14	6.7	
Richmond	144	145	158	29.87	30.01	.00	78.2	+ 1.3	94	6	86	63	29	70	22	....	....	....	8.68	+ 3.8	14	4,818	s.	24	nw.	7	4	16	11	5.9	
Wytheville	2,293	40	47	27.71	30.01	.00	73.6	+ 3.1	87	23	82	59	31	65	23	68	67	92	7.04	+ 2.5	21	2,210	sw.	15	w.	10	2	22	7	6.0	
S. Atlantic States.							80.0	+ 2.1								86	6.21	— 0.2											6.0	
Asheville	2,255	53	75	27.73	30.01	— .01	74.1	+ 3.6	88	20	83	62	8	65	24	68	68	91	3.89	— 0.7	19	3,209	se.	24	e.	25	1	16	14	7.1	
Charlotte	773	68	76	29.21	30.02	.00	78.7	+ 2.6	91	9	86	68	1	71	21	73	71	87	8.56	+ 3.2	23	3,342	sw.	28	nw.	10	2	17	12	6.8	
Hatteras	11	12	47	30.02	30.03	+ .03	79.7	+ 2.3	89	10	84	71	1	75	12	76	75	88	5.45	— 0.9	12	8,453	sw.	35	sw.	27	15	10	6	4.5	
Raleigh	376	71	79	29.62	30.01	.00	79.9	+ 4.2	95	11	88	70	2	72	22	74	72	86	8.28	+ 2.1	22	3,421	sw.	20	se.	2	5	17	9	6.1	
Wilmington	78	81	91	29.92	30.00	.00	80.6	+ 2.4	96	10	87	70	20	74	19	75	74	85	4.64	— 2.8	20	4,868	sw.	25	s.	11	1	21	9	6.2	
Charleston	48	14	92	29.97	30.02	+ .01	81.7	+ 1.2	97	10	87	72	2	77	18	76	74	81	7.87	+ 0.2	18	6,577	s.	27	s.	28	5	21	5	5.5	
Columbia, S. C.	351	41	57	29.64	30.01	.00	81.1	+ 1.3	95	10	90	69	1	73	20	74	73	86	6.85	0.0	18	3,606	s.	24	ne.	12	4	12	15	6.6	
Augusta	180	89	97	29.81	30.00	+ .01	81.4	+ 2.0	95	10	90	68	2	73	21	74	73	84	6.16	+ 1.0	17	3,633	se.	37	e.	22	5	20	6	5.5	
Savannah	65	81	89	29.95	30.02	+ .01	81.6	+ 1.3	96	10	89	70	1	74	21	75	73	83	5.06	— 2.7	9	4,727	sw.	26	sw.	28	4	17	10	5.8	
Jacksonville	43	101	129	29.95	30.00	— .01	81.4	+ 0.3	96	10	88	70	31	75	19	75	73	84	5.38	— 1.1	13	5,768	se.	33	nw.	27	6	17	8	5.5	
Florida Peninsula.							81.4	— 0.7								82	7.39	+ 1.0											5.4	
Jupiter	38	10	48	29.98	30.01	+ .01	80.4	— 0.6	89	1	86	71	13	75	15	76	75	84	8.55	+ 3.0	22	6,942	se.	36	w.	26	7	18	6	5.5	
Key West	22	10	53	29.97	29.99	+ .01	82.8	— 1.1	91	26	88	75	3	78	14	76	73	76	3.00	— 1.8	19	5,993	e.	27	sw.	4	5	21	5	5.4	
Sand Key	25	41	71	29.95	29.98	.00	81.8	.....	94	1	86	72	31	78	17	....	....	....	2.20	.....	15	8,973	e.	54	s.	4	6	22	3	5.0	
Tampa	35	79	96	29.96	29.99	+ .01	81.0	— 0.4	94	9	88	70	1	74	19	75	74	85	10.61	+ 1.9	22	5,024	e.	31	w.	27	8	14	9	5.6	
East Gulf States.							80.9	+ 1.4								82	4.77	— 0.7											5.4	
Atlanta	1,174	190	216	28.80	30.01	.00	78.6	+ 2.1	92	22	86	65	1	71	20	72	70	83	1.51	— 3.2	9	5,497	se.	48	w.	10	3	19	9	6.0	
Macon	370	55	66	29.62	30.01	.00	82.1	+ 1.7	96	10	91	69	1	73	24	....	....	....	6.22	+ 1.0	17	2,465	s.	30	se.	22	3	24	4	5.8	
Thomasville	273	8	57	29.71	30.00	.00	80.8	+ 1.1	98	10	90	68	1	72	25	75	73	88	7.51	+ 0.8	19	2,814	se.	24	s.	5	15	13	3	4.3	
Pensacola	56	79	96	29.92	29.98	.00	82.1	+ 1.7	96	25	88	70	26	76	22	....	....	....	1.61	— 6.8	7	5,771	s.	41	nw.	26	6	19	6	5.4	
Anniston	741	9	58	29.24	30.02	+ .03	79.2	+ 1.3	93	21	89	63	1	70	24	....	....	....	5.35	+ 0.8	18	2,281	se.	21	nw.	11	5	12	14	6.9	
Birmingham	700	136	144	29.27	30.02	+ .03	79.7	— 0.1	93	20	88	68	4	72	22	73	71	81	6.34	+ 0.8	16	3,665	sw.	31	se.	21	0	20	11	6.8	
Mobile	57	98	106	29.92	29.98	.00	82.4	+ 2.1	97	23	90	69	4	74	22	75	73	80	3.36	— 3.5	10	4,168	n.	28	nw.	26	8	16	7	5.2	
Montgomery	223	100	112	29.76	30.00	+ .01	81.8	+ 2.0	96	22	91	68	10	72	24	74	72	81	1.80	— 2.3	11	3,459	se.	28	ne.	3	9	19	3	4.7	
Meridian	375	84	93	29.60	29.98	.00	79.6	+ 1.8	95	23	90	64	30	70	27	72	70	80	8.95	+ 4.5	11	2,364	sw.	26	e.	13	13	13	5	4.1	
Vicksburg	247	62	74	29.72	30.00	+ .02	80.6	+ 0.5	95	17	90	62	28	71	26	74	72	82	4.93	+ 1.4	11	3,290	se.	34	nw.	26	15	13	3	4.2	
New Orleans	51	88	121	29.93	29.98	.00	83.2	+ 1.7	95	25	91	69	12	76	25	76	73	80	4.88	— 1.2	10	4,763	se.	32	se.	6	3	17	11	6.2	
West Gulf States.							80.8	— 0.3								79	3.07	— 0.3											4.6	
Shreveport	249	77	84	29.72	29.98	+ .01	81.3	0.0	96	15	91	60	28	72	30	72	70	77	2.29	+ 0.1	10	3,354	sw.	31	ne.	17	17	11	3	3.6	
Bentonville	1,303	11	44	28.60	29.96	— .01	74.4	.....	90	16	84	48	28	65	33	....	....	....	7.33	.....	18	2,561	s.	17	sw.	23	10	9	12	5.8	
Fort Smith	457	79	94	29.50	29.97	.00	78.0	+ 0.3	94	16	88	54	28	68	30	71	69	83	6.48	+ 2.7	15	3,991	e.	40	se.	16	9	18	4	4.4	
Little Rock	357	93	100	29.62	29.99	+ .01	78.8	+ 0.6	94	22	88	58	29	70	26	72	69	79	3.43	— 0.7	10	3,707	nw.	32	nw.	11	11	12	8	5.1	
Corpus Christi	20	48	53	29.93	29.95	+ .02	82.1	+ 0.7	90	25	87	71	18	77	16	76	75	82	2.20	— 0.9	4	7,699	se.	30	se.	9	19	7	5	3.6	
Fort Worth	670	106	114	29.26	29.96	+ .02	80.4	— 3.2	94	30	89	56	28	72	28	....	....	....	4.98	+ 3.0	7	6,367	sw.	30	ne.	11	15	14	2	3.8	
Galveston	54	106	112	29.92	29.98	+ .02	83.0	— 0.2	90	26	87	74	28	79	13	76	74	78	1.47	— 4.1	5	6,193	se.	26	se.	9	17	10	4	3.9	
Palestine	510	73	79	29.44	29.96	— .01	80.5	+ 0.1	94	30	89	59	28	72	32	72	70	79	1.43	— 1.2	11	4,347	s.	22	s.	5	5	14	12	6.8	
San Antonio	701	80	91	29.22	29.93	.00	82.0	— 0.2	96	29	92	62	28	72	30	72	69	73	2.25	— 1.6	9	4,468	se.	22	n.	26	10	20	1	4.1	
Taylor	583	55	63	29.35	29.96	+ .01	80.9	.....	94	8	90	50	28	71	29	....	....	....	2.08	.....	5	5,157	s.	30	s.	21	13	11	7	4.4	
Ohio Val. and Tenn.							77.2	+ 2.7								79	5.53	+ 0.1											5.6	
Chattanooga	762	106	112	29.23	30.02	+ .02	78.6	+ 2.7	92	19	87	66	2	70	22	71	70	81	3.20	— 0.6	15	3,391	sw.	24	se.	5	5	20	6	5.9	
Knoxville	1,004	35	88	28.98	30.01	.00	78.2	+ 3.4	93	18	87	64	1	69	24	71	70	86	1.35	— 2.7	11	3,678	sw.	40	nw.	9	1	19	11	6.8	
Memphis	399	76	97	29.59	30.01	+ .03	79.1	+ 0.4	93	19	86	59	28	72	20	73	71	81	2.32	— 1.3	11	4,296	sw.	35	sw.	11	9	15	7	4.9	
Nashville	546	79	91	29.44	30.01	+ .01	79.0	+ 1.5	94	19	88	61	29	70	26	71	69	80	2.94	— 0.5	11	3,382	sw.	28	se.	18	7	11	13	6.5	
Lexington	989	75	102	28.98	30.02	+ .01	75.8	+ 1.8	90	19	84	56	28	68	20	....	....	....	4.92	+ 1.4	13	5,067	sw.	30	se.	17	8	11	12	5.4	
Louisville	825	111	132	29.44	30.01	+ .01	79.4	+ 3.1	96	24	88	56	28	70	26	71	68	75	1.92	— 1.6	9	4,332	s.	29	ne.	11	9	13	9	5.4	
Evansville	431	72	82	29.52	29.98	— .01	78.6	.....	93	20	87	57	28	70	23	....	....	....	4.39	.....	10	3,661	s.	28	s.	26	12	14	5	4.4	
Indianapolis	822	154	164	29.13	30.00	.00	76.4	+ 2.8	92	4	85	54	28	67	24	69	66	77	5.23	+ 2.0	12	5,122	ne.	31	se.	25	9	15	7	5.1	
Cincinnati	628	152	160	29.34	30.00	— .01	78.4	+ 3.4	93	19	86	59	28	70	24	69	66	72	3.78	+ 0.1	14	3,677	ne.	24	sw.	8	8	18	5	5.0	
Columbus	824	173	190	29.14	30.00	— .01	75.7	+ 3.4	91	19	84	54	28	67	25	68	66	77	6.15	+ 2.9	11	4,913	se.	39	se.	17	7	19	5	5.1	
Pittsburg	842	336	352	29.12	30.00	— .01	75.6	+ 2.8	90	5	84	53	28	67	28	68	64	74	2.96	— 0.2	13	5,270	ne.	25	nw.	27	7	15	9	5.7	
Parkersburg	638	77	84	29.36	30.01	.00	77.3	+ 3.7	91	19	87	57	29	68	29	70	68	81	3.32	0.0	11	2,813	sw.	24	w.	7	11	14	6	4.4	
Elkins	1,940	41	50	28.04	30.02	.00	78.0	+ 3.7	88	5	82	55	31	64	28	67	66	89	4.84	+ 1.6	16	1,906	w.	16	n.	12	1	8	22	7.8	
Lower Lake Region.							73.2	+ 3.8								75	3.42	+ 0.6											4.4	
Buffalo	767	178	206	29.18	29.99	.00	72.4	+ 3.9	87	26	79	53	13	65	30	66	62	73	1.82	— 1.4	9	7,871	sw.	41	w.	20	8	17	6	5.2	
Canton	448	10	71	29.53	29.99	.....	69.3	.....	89	19	80	41	15	58	32	....	....	....	2.64	.....	10	6,148	sw.	36	sw.	30	17	12	2	3.5	
Oswego	335	76	91	29.63	29.99	.00	70.8	+ 2.6	89	5	78	52	16	63	26	66	64	81	2.83	+ 1.9	7	5,727	s.	28	ne.	23	13	10	8	4.5	
Rochester	523	81	102	29.45	30.01	+ .02	72.6	+ 4.2	93	5	82	50	13	64	29	65	62	74	2.31	— 0.8	9	4,712	sw.	23	ne.	23	13	8	10	5.0	
Syracuse	597	97	113	29.38	30.02	+ .03	71.0	.....	90	5	79	50	13	63	28	....	....	....	2.76	.....	7	6,214	s.	36	w.	20	5	20	6	5.3	
Erie	713	92	102	29.24	29.99	— .02	72.8	+ 3.3	90	5	80	53	13	66	28	66	62	72	4.16	+ 0.9	7	6,647	w.	30	se.	25	15	12	4	4.1	
Cleveland	762	190	201	29.19	29.99	— .02	73.2	+ 3.6	88	26	80	56	14	67	24	67	64	75	3.45	+ 0.4	11	8,161	se.	42	n.	27	8	17	6	4.8	
Sandusky	629	62	70	29.33	30.00	— .01	75.0	+ 4.0	92	4	82	56	31	67	25	....	....	....	6.65	+ 3.5	12	4,609	sw.	32	w.	26	14	11	6	3.9	
Toledo	628	207	246	29.33	30.00	.00	74.6	+ 3.8	92	21	83	54	28	66	23	67	65	77	2.89	+ 0.2	11	8,281	sw.	41	s.	5	17	10	4	3.5	
Detroit	730	153	193	29.22	29.99	— .02	74.4	+ 4.7	91	22	83	56	13	66	23	67	64	76	3.25	+ 0.5	10	6,352	sw.	36	sw.	26	15	9	7	4.0	
Upper Lake Region.							69.8	+ 3.7								78	3.01	+ 0.1											4.3	
Alpena	609	13	92	29.34	30.01	+ .01	67.9	+ 4.4	88	26	77	42	31	59	30	63	61	83	2.68	— 0.8	10	6,139	se.	25	e.	24	14	13	4	3.8	
Escanaba	612	40	82	29.33	29.99	.00	67.4	+ 2.8	85	18	76	45	31	59	25	62	58	77	3.11	— 0.7	12	6,426	s.	26	s.	2	13	11	7	4.5	
Grand Haven	632	54	92	29.30	29.97	— .02	71.4	+ 4.4	89	17	80	48	28	63	25	66	64	80	2.49	— 0.2	8	6,101	sw.	28	sw.	29	9	17	5	5.0	

TABLE I.—*Climatological data for U. S. Weather Bureau stations, August, 1906*—Continued.

Stations.	Elevation of instruments.			Pressure, in inches.			Temperature of the air, in degrees Fahrenheit.								Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches.			Wind.				Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness during daylight, tenths.	Total snowfall.
	Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Mean max. + mean min. ÷ 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.			Total.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Maximum velocity. Miles per hour.	Maximum velocity. Direction.	Maximum velocity. Date.				
Up. Lake Reg—Con't.																												
Grand Rapids	707	121	162	29.24	29.99	— .01	73.4	+ 3.2	92	2	83	50	28	64	31	66	62	75	1.83	— 0.6	9	6,006	e.	38	sw.	29	8	15	8	5.5	
Houghton	668	66	74	29.26	29.98	+ .01	65.8	.....	89	2	75	45	31	57	31	.....	.....	....	4.62	.....	12	4,412	e.	32	nw.	29	12	11	8	4.6	
Marquette	734	77	116	29.20	29.99	+ .01	65.6	+ 2.0	86	15	73	44	31	58	23	60	57	77	3.23	+ 0.3	11	5,918	n.	36	w.	29	11	12	8	5.3	
Port Huron	638	70	120	29.31	30.00	.00	72.6	+ 5.6	92	22	82	52	31	64	25	66	63	78	0.94	— 1.6	9	6,256	ne.	42	w.	4	12	11	8	5.0	
Sault Ste. Marie	614	40	61	29.32	30.00	+ .01	65.7	+ 4.9	87	17	76	42	31	56	35	60	57	78	1.68	— 1.1	9	5,157	se.	38	nw.	29	11	12	8	5.0	
Chicago	823	140	310	29.12	29.98	— .02	75.6	+ 4.7	92	22	82	56	27	70	21	68	65	76	1.43	— 1.5	9	8,312	sw.	41	w.	9	11	13	7	4.9	
Milwaukee	681	122	142	29.27	30.00	.00	73.0	+ 4.7	92	21	80	53	27	66	20	67	64	81	3.87	+ 1.1	11	6,408	ne.	34	se.	17	16	7	8	4.2	
Green Bay	617	49	86	29.31	29.96	— .03	70.8	+ 4.1	93	20	80	48	27	61	28	64	62	78	7.93	+ 5.3	11	6,041	sw.	40	se.	25	9	11	11	5.9	
Duluth	1,133	11	47	28.76	29.96	— .01	64.0	+ 0.3	88	16	72	42	31	56	29	58	55	76	3.95	+ 0.6	9	9,442	ne.	38	ne.	23	13	10	8	4.3	
North Dakota.							**66.8**	**+ 0.4**										**74**	**2.33**	**0.0**									**4.8**	
Moorhead	940	8	57	28.95	29.96	.00	67.0	+ 1.8	92	16	77	41	27	57	37	62	58	84	2.56	— 1.2	10	4,509	se.	24	nw.	29	10	10	11	5.4	
Bismarck	1,674	15	57	28.21	29.97	+ .03	67.4	— 0.1	99	16	79	46	30	56	43	60	56	73	2.04	+ 0.1	10	7,026	se.	37	s.	17	15	8	8	4.8	
Devils Lake	1,482	11	44	28.40	29.95	+ .01	66.0	.....	101	16	80	39	30	52	43	58	54	70	0.50	.....	6	7,955	se.	38	nw.	27	14	8	9	4.6	
Williston	1,875	14	44	27.97	29.91	— .02	65.9	— 0.6	98	18	78	40	26	54	37	58	54	69	2.39	+ 1.2	12	5,879	se.	40	nw.	9	17	5	9	4.6	
Upper Miss. Valley.							**74.6**	**+ 2.2**										**77**	**4.42**	**+ 1.4**									**4.8**	
Minneapolis	.....	102	208	.....	.....	.....	71.4	+ 2.3	93	16	80	49	27	63	26	....	....	...	3.32	+ 0.1	10	8,190	se.	32	nw.	26	7	12	12	5.9	
St. Paul	837	171	179	29.05	29.94	— .03	71.3	+ 2.2	93	16	80	48	27	62	29	64	61	75	1.83	— 1.5	9	6,540	se.	32	nw.	26	10	11	10	5.6	
La Crosse	714	71	87	29.20	29.95	— .03	73.2	+ 3.1	93	20	82	49	27	64	25	....	....	...	5.30	+ 2.0	11	4,442	s.	23	nw.	26	10	12	9	5.2	
Madison	974	70	78	28.94	29.96	— .03	71.9	+ 2.2	89	2	80	52	27	63	25	66	63	78	7.56	+ 4.5	14	5,445	s.	36	sw.	28	14	11	6	4.2	
Charles City	1,015	8	58	28.90	29.96	— .01	71.8	— 0.2	92	16	82	42	27	62	31	66	64	84	4.52	+ 1.7	11	4,125	se.	24	s.	28	6	13	12	5.8	
Davenport	606	71	79	29.31	29.96	— .02	76.2	+ 3.4	94	23	86	49	27	67	25	68	65	74	3.50	— 0.1	11	4,178	w.	21	nw.	19	16	7	8	4.0	
Des Moines	861	84	101	29.07	29.95	— .02	74.9	+ 2.9	97	16	85	46	27	65	29	67	64	74	4.86	+ 1.6	11	4,646	sw.	28	sw.	28	11	16	4	5.0	
Dubuque	698	100	117	29.24	29.97	— .01	74.2	+ 2.6	92	23	84	48	27	65	26	67	64	76	4.44	+ 1.3	12	4,080	se.	24	s.	28	13	12	6	4.6	
Keokuk	614	64	78	29.32	29.98	.00	76.6	+ 2.1	95	2	87	50	27	66	29	68	65	74	2.87	0.0	10	4,137	sw.	24	nw.	17	14	12	5	3.7	
Cairo	356	87	93	29.62	29.99	.00	77.9	+ 0.9	91	19	86	59	28	70	23	73	72	90	5.73	+ 2.9	9	3,986	sw.	28	nw.	10	7	15	9	5.6	
La Salle	536	56	64	29.42	29.99	.00	75.2	.....	95	3	86	50	28	64	31	....	....	...	7.25	.....	12	3,758	sw.	32	s.	3	14	9	8	4.5	
Peoria	609	11	45	29.33	29.99	.00	75.4	.....	95	3	87	44	28	64	36	67	64	75	1.59	.....	11	4,145	s.	47	sw.	9	19	9	3	3.4	
Springfield, Ill	644	10	92	29.30	29.98	— .01	77.0	+ 3.6	95	3	88	50	28	66	30	68	65	73	4.88	+ 2.5	10	4,542	sw.	39	nw.	17	13	12	6	4.7	
Hannibal	534	75	109	29.40	29.97	— .01	75.9	+ 1.7	94	4	87	48	28	65	32	....	....	....	4.90	+ 2.6	9	5,041	sw.	30	nw.	18	7	19	5	4.8	
St. Louis	567	208	217	29.38	29.97	— .02	78.1	+ 1.3	93	2	86	57	27	70	24	69	65	70	3.72	+ 0.2	7	5,842	sw.	26	sw.	9	12	13	6	4.6	
Missouri Valley.							**74.1**	**+ 1.1**										**74**	**5.12**	**+ 2.1**									**4.7**	
Columbia, Mo	784	11	84	29.16	29.96	— .01	76.2	+ 0.2	95	3	88	47	28	65	34	....	....	....	2.94	+ 0.4	8	4,062	s.	26	se.	24	10	17	4	4.5	
Kansas City	963	78	95	28.98	29.98	+ .01	77.6	+ 1.9	93	17	86	57	27	70	26	69	66	72	9.09	+ 5.2	11	4,721	s.	23	n.	26	13	14	4	4.2	
Springfield, Mo	1,324	98	104	28.62	30.00	+ .03	74.1	+ 0.1	89	16	82	51	27	66	27	68	66	83	6.09	+ 2.4	16	5,064	s.	31	w.	10	14	8	9	4.7	
Iola	984	40	47	28.95	29.97	+ .01	76.7	.....	94	16	86	50	27	67	29	....	....	....	3.05	.....	11	4,316	s.	35	w.	10	9	8	14	5.9	
Topeka	.....	85	89	.....	.....	.....	76.8	+ 2.0	96	16	86	50	27	67	30	...	...	...	7.67	+ 3.8	10	5,075	s.	29	s.	5	16	9	6	3.7	
Lincoln	1,189	11	84	28.69	29.92	— .03	76.2	+ 2.6	98	16	87	47	27	65	33	67	64	72	2.74	— 0.5	10	6,399	s.	32	sw.	7	15	8	8	4.5	
Omaha	1,105	115	121	28.79	29.94	— .02	75.8	+ 2.1	97	16	85	52	27	67	29	67	63	71	2.03	— 1.3	9	4,684	s.	29	n.	26	12	9	10	5.1	
Valentine	2,598	47	84	27.28	29.95	+ .01	70.2	— 0.1	97	16	82	44	26	58	41	61	57	71	5.02	+ 3.0	13	6,489	s.	37	se.	31	14	14	3	3.9	
Sioux City	1,135	96	164	28.74	29.93	— .02	73.0	+ 1.4	96	16	82	43	27	64	33	....	....	....	2.74	— 0.4	9	7,567	se.	32	se.	1	11	10	10	5.0	
Pierre	1,572	43	50	28.29	29.93	— .01	72.2	— 0.6	101	16	83	46	27	61	36	63	59	71	5.16	+ 3.5	10	4,640	se.	24	se.	13	15	5	11	4.7	
Huron	1,306	56	67	28.57	29.95	.00	70.2	+ 1.8	98	16	81	41	27	59	39	63	60	77	4.73	+ 2.2	12	6,653	se.	30	s.	14	12	14	5	4.6	
Yankton	1,233	49	57	28.62	29.91	— .04	72.9	+ 1.1	99	16	84	47	27	62	31	....	....	....	8.16	+ 5.1	11	4,461	e.	24	s.	14	9	7	15	6.0	
Northern Slope.							**67.3**	**— 0.5**										**63**	**2.63**	**+ 1.3**									**4.0**	
Havre	2,505	11	44	27.32	29.91	.00	66.7	+ 1.1	103	12	81	40	26	53	43	57	50	64	1.63	+ 0.2	6	5,764	e.	56	sw.	13	17	10	4	3.8	
Miles City	2,371	26	48	27.45	29.95	+ .02	70.3	— 1.4	106	12	83	41	26	58	44	59	52	62	2.04	+ 1.0	14	3,665	ne.	36	w.	31	13	10	8	4.4	
Helena	4,110	8	56	25.82	29.95	+ .01	65.4	— 1.1	97	17	78	40	26	53	36	53	46	58	1.79	+ 1.2	11	4,473	sw.	48	sw.	13	12	9	10	4.8	
Kalispell	2,962	8	34	26.90	29.91	+ .02	63.7	.....	92	11	78	40	26	50	37	52	45	59	1.98	.....	9	3,798	w.	30	w.	31	19	8	4	3.5	
Rapid City	3,284	46	50	26.61	29.96	+ .03	67.3	— 2.6	97	16	78	43	26	57	37	60	56	72	5.67	+ 4.4	12	5,081	se.	36	nw.	19	13	2	16	5.2	
Cheyenne	6,088	56	64	24.09	29.93	+ .01	64.7	— 0.3	88	17	79	43	8	51	38	52	45	58	0.49	— 1.1	13	5,884	nw.	35	s.	30	19	9	3	3.1	
Lander	5,372	26	36	24.70	29.94	+ .02	65.0	+ 0.1	94	16	81	35	26	50	44	53	47	62	1.26	+ 0.6	9	2,365	sw.	34	s.	17	11	16	4	4.1	
Yellowstone Park	6,200	11	48	23.94	29.94	+ .01	59.3	.....	87	16	74	32	26	45	42	48	40	60	1.47	.....	15	4,768	sw.	33	nw.	18	13	13	5	4.4	
North Platte	2,821	11	51	27.08	29.96	+ .02	71.9	+ 0.5	96	1	85	44	26	59	40	63	59	74	5.56	+ 3.1	9	4,874	se.	33	sw.	1	21	7	3	2.5	
Middle Slope.							**74.8**	**+ 0.2**										**68**	**3.33**	**+ 0.9**									**4.2**	
Denver	5,291	129	136	24.79	29.95	+ .03	70.2	+ 0.1	93	16	84	50	26	56	34	56	49	58	0.88	— 0.6	10	4,535	s.	35	ne.	4	15	13	3	3.7	
Pueblo	4,685	80	86	25.32	29.90	— .01	72.4	+ 0.1	96	21	86	51	31	58	36	57	48	52	1.55	— 0.5	5	4,789	se.	44	nw.	9	19	11	1	2.7	
Concordia	1,398	42	47	28.51	29.94	— .01	77.6	+ 3.2	98	18	89	47	27	66	34	68	64	70	1.73	— 0.9	5	4,732	s.	22	nw.	10	12	15	4	4.1	
Dodge	2,509	44	54	27.40	29.94	+ .01	74.8	— 0.4	95	22	87	45	27	62	32	66	63	77	4.19	+ 1.3	7	6,714	se.	43	nw.	10	12	18	1	4.5	
Wichita	1,358	78	86	28.57	29.97	+ .02	77.3	+ 0.8	94	10	88	50	27	67	31	69	66	75	3.30	+ 0.3	10	5,141	s.	27	n.	10	12	13	6	5.0	
Oklahoma	1,214	10	47	28.70	29.94	.00	76.4	— 2.6	92	15	86	52	27	67	26	70	68	79	8.34	+ 5.6	15	9,001	s.	38	n.	23	10	13	8	5.5	
Southern Slope.							**76.4**	**— 1.2**										**72**	**4.62**	**+ 2.5**									**4.8**	
Abilene	1,738	45	54	28.18	29.95	+ .03	78.1	— 2.1	93	29	87	59	28	69	29	70	66	74	5.45	+ 2.8	6	4,983	s.	23	se.	31	3	20	8	6.2	
Amarillo	3,676	10	49	26.28	29.94	+ .02	73.4	+ 0.5	93	22	85	53	27	62	35	64	60	72	6.76	+ 4.4	9	7,921	se.	50	se.	7	19	11	1	2.9	
Del Rio	944	8	57	28.93	29.90	.00	80.8	.....	99	26	90	66	28	71	29	....	....	....	3.64	.....	9	5,375	se.	31	sw.	10	8	18	5	5.2	
Roswell	3,578	9	57	26.32	29.87	— .01	74.7	— 2.0	94	7	87	57	27	62	32	64	60	70	1.83	+ 0.4	9	3,619	se.	26	nw.	24	11	15	5	4.9	
Southern Plateau.							**75.6**	**— 2.2**										**54**	**2.17**	**— 0.6**									**3.8**	
El Paso	3,762	10	110	26.17	29.84	.00	76.8	— 2.2	94	7	87	59	31	66	29	64	58	61	4.10	+ 2.3	11	6,678	e.	35	nw.	1	8	18	5	5.2	
Santa Fe	7,013	33	39	23.35	29.88	— .01	65.6	— 0.7	83	14	77	48	29	54	29	53	46	59	1.84	— 0.8	11	4,463	se.	29	e.	5	14	16	1	3.7	
Flagstaff	6,907	12	44	23.44	29.87	+ .03	60.7	— 4.0	81	4	74	38	26	48	38	52	48	71	3.28	0.0	14	3,592	n.	24	sw.	30	4	18	9	5.8	
Phoenix	1,108	50	56	28.66	29.78	— .01	85.7	— 2.5	106	14	98	67	26	74	31	68	58	47	2.07	+ 1.2	5	3,187	e.	28	n.	14	13	14	4	4.2	
Yuma	141	16	46	29.61	29.75	— .01	88.9	— 1.8	111	13	102	68	23	76	36	71	63	30	1.69	+ 1.3	4	4,024	se.	34	e.	17	26	3	2	1.5	
Independence	3,910	11	42	25.95	29.84	+ .03	75.6	— 2.0	98	16	91	50	22	60	38	57	41	34	0.04	— 0.2	3	4,473	nw.	26	**nw.**	10	23	5	3	2.3	
Middle Plateau.							**70.1**	**— 0.9**										**46**	**1.36**	**+ 0.6**									**3.6**	
Reno	4,532	56	63	25.46	29.86	+ .02	70.4	+ 1.7	95	9	87	42	23	54	44	54	43	47	0.15	0.0	2	3,983	w.	29	s.	10	23	6	2	2.0	
Tonopah	6,089	12	20	24.10	29.90	.....	71.4	.....	92	15	82	47	21	60	27	52	36	34	1.55	.....	7	5,513	se.	36	**se.**	16	17	12	2	3.5	
Winnemucca	4,344	18	56	25.58	29.89	+ .01	69.6	— 1.0	97	16	89	38	24	50	47	51	37	38	0.45	+ 0.4	4	3,552	sw.	32	s.	8	22	5	4	3.0	
Modena	5,479	10	43	24.63	29.87	+ .01	68.4	— 1.3	92	15	82	44	24	55	38	54	45	54	3.40	+ 2.2	12	7,231	w.	37	sw.	18	12	13	6	4.6	
Salt Lake City	4,366	105	110	25.59	29.87	— .04	73.0	— 1.6	96	10	85	50	25	61	34	57	47	44	2.28	+ 1.6	10	4,313	se.	36	e.	3	16	11	4	3.4	
Durango	6,546	18	56	23.74	29.91	+ .01	64.6	— 2.3	87	7	80	44	26	50	39	52	45	60	1.33	— 0.5	11	4,021	nw.	29	s.	9	10	13	8	5.0	
Grand Junction	4,608	43	51	25.38	29.90	.00	74.5	— 1.1	96	11	88	52	26	61	35	56	45	42	0.56	— 0.6	7	3,313	nw.	24	w.	13	15	12	4	3.9	
Northern Plateau.							**71.0**	**0.0**										**42**	**0.73**	**+ 0.4**									**3.1**	
Baker City	3,471	48	58	26.42	29.94	— .01	66.6	+ 0.5	97	10	82	41	23	52	39	51	39	43	0.39	+ 0.2	4	4,602	nw.	36	sw.	12	22	7	2	2.5	
Boise	2,739	78	86	27.09	29.88	— .05	72.8	+ 0.6	102	10	88	48	24	58	38	55	40	36	0.13	— 0.1	4	3,444	se.	27	nw.	22	19	12	0	2.9	
Lewiston	757	10	51	29.10	29.90	— .05	73.9	— 0.8	107	11	89	51	19	59	40	....	....	....	1.61	+ 1.0	5	3,854	e.	38	w.	12	17	10	4	3.4	
Pocatello	4,477	46	54	25.48	29.91	— .01	69.4	— 0.2	96	10	83	43	25	55	40	53	42	45	1.25	+ 0.8	9	5,474	**se.**	33	se.	19	17	13	1	2.9	
Spokane	1,929	101	110	27.91	29.92	— .03	68.4	— 0.6	98	11	83	44	20	54	41	53	41	44	0.34	0.0	2	3,714	sw.	32	se.	12	18	5	8	3.6	
Walla Walla	1,000	71	79	28.86	29.91	— .05	74.6	+ 0.4	103	11	88	53	22	62	33	59	48	42	0.68	+ 0.5	5	4,007	s.	38	sw.	12	23	8	0	3.2	
N. Pac. Coast Reg.							**61.9**	**+ 0.5**										**74**	**0.20**	**— 0.7**									**4.4**	
North Head	211	11	56	29.84	30.06	+ .03	56.6	— 2.5	76	26	60	49	19	53	21	55	53	90	0.03	— 1.0	2	10,775	nw.	38	nw.	6	6	11	14	6.5	
Port Crescent	259	12	29	29.77	30.05	+ .03	55.4	— 1.3	78	26	64	38	17	46	32	....	....	....	0.38	— 0.4	2	3,549	nw.	13	sw.	20	13	13	5	4.5	
Seattle	123	185	224	29.90	30.03	+ .03	65.0	+ 0.7	81	29	74	50	18	55	26	57	51	64	0.15	— 0.4	2	4,833	nw.	26	**s.**	14	13	15	3	4.1	
Tacoma	213	113	120	29.79	30.01	— .01	64.1	+ 2.5	84	11	75	45	17	53	29	....	....	....	0.08	— 0.6	2	3,245	n.	18	sw.	13	14	8	9	4.2	
Tatoosh Island	86	7	57	29.95	30.04	+ .04	55.2	— 0.6	66	26	60	48	29	51	17	54	52	91	0.69	— 1.7	3	8,225	sw.	36	s.	14	9	6	16	6.6	
Portland, Oreg	153	68	96	29.82	29.98	— .04	68.2	+ 2.3	89	11	80	48	17	56	30	59	52	62	0.05	— 0.5	1	3,689	nw.	19	w.	12	19	9	3	3.4	
Roseburg	510	9	57	29 42	29.96	— .04	68.5	+ 2.3	98	26	86	42	21	51	46	57	50	61	0.01	— 0.2	1	2,653	nw.	18	n.	18	25	4	2	1.5	

TABLE I.—*Climatological data for U. S. Weather Bureau stations, August, 1906*—Continued.

Stations.	Elevation of instruments.			Pressure, in inches.			Temperature of the air, in degrees Fahrenheit.								Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches.			Wind.					Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness during daylight, tenths.	Total snowfall.
	Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Mean max. + mean min. ÷ 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.				Total.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Maximum velocity. Miles per hour.	Maximum velocity. Direction.	Maximum velocity. Date.					
Mid. Pac. Coast Reg.							64.2	— 0.4									63	0.02	— 0.1									4.0	
Eureka	62	62	80	29.93	30.00	.00	54.4	— 1.5	65	12	58	47	18	51	14	52	50	86	0.01	— 0.1	1	4,010	nw	34	nw.	14	2	15	14	6.7	
Mount Tamalpais	2,375	11	18	27.49	29.91	— .02	71.4	.....	91	14	78	45	19	65	20	55	43	41	0.00	.....	0	9,414	nw.	54	nw.	12	26	4	1	1.1	
Point Reyes Light	490	7	18	29.37	29.88	.....	53.8	— 1.1	65	21	58	45	1	50	14	....	....	....	0.00	— 0.2	0	12,543	nw.	60	nw.	12	5	6	20	7.7	
Red Bluff	332	50	56	29.46	29.80	— .06	82.1	+ 1.0	105	15	98	57	23	66	36	63	50	41	0.00	— 0.2	0	3,276	se.	24	n.	24	27	2	2	1.1	
Sacramento	69	106	117	29.76	29.83	— .02	72.9	+ 0.2	103	15	88	50	23	58	37	61	54	58	T.	0.0	0	6,114	s.	21	sw.	21	29	1	1	0.8	
San Francisco	287	29	42	29.75	29.92	.00	57.9	— 0.8	76	14	64	50	11	52	23	54	52	88	0.11	+ 0.1	2	6,513	w.	22	w.	2	6	15	10	5.5	
San Jose	141	78	88	29.74	29.88	. .....	67.0	.....	96	14	81	47	22	53	47	....	....	....	0.00	.....	0	.....	nw.	.....	.....	...	31	0	0	1.7	
Southeast Farallon	30	9	17	29.90	29.93	.....	54.1	.....	63	21	56	48	3	52	8	....	....	....	0.00	.....	0	9,280	nw.	44	nw.	12	5	5	21	7.8	
S. Pac. Coast Reg.							71.4	0.0									68	0.04	0.0									2.6	
Fresno	330	67	70	29.46	29.80	— .02	82.2	+ 0.5	107	12	99	55	23	65	38	61	46	36	0.00	0.0	0	4,255	nw.	17	nw.	27	30	1	0	0.3	
Los Angeles	338	116	123	29.53	29.88	.00	70.5	+ 0.1	92	14	80	52	25	61	30	62	59	78	0.03	0.0	1	4,260	w.	19	sw.	25	21	7	3	3.4	
San Diego	87	94	102	29.78	29.87	— .02	68.5	— 0.4	78	14	73	57	25	64	18	63	61	81	0.10	0.0	2	4,379	nw.	19	nw.	12	25	3	3	3.1	
San Luis Obispo	201	47	54	29.70	29.92	— .02	64.6	— 0.2	95	14	76	47	22	53	43	57	53	76	0.03	0.0	1	2,717	nw.	16	w.	22	22	5	4	3.6	
West Indies.																															
Grand Turk	11	6	20	30.02	30.03	.....	.....	.....	92	23	....	73	18	78	....	....	....	....	0.72	.....	10	.....	e.	.....	.....	...	...	...	...	...	
San Juan	82	48	90	29.89	29.97	.00	81.2	— 0.2	87	6	86	73	16	76	13	76	73	78	4.77	— 1.1	20	9,005	e.	30	se.	23	14	13	4	4.5	
Panama.																															
Ancon	74	....	....	.....	.....	.....	.....	.....	....	....	....	....	....	....	....	....	....	....	.....	.....	....	.....	.....	.....	.....	....	....	....	....	....	
Naos	40	....	....	.....	.....	.....	.....	.....	....	....	....	....	....	....	....	....	....	....	.....	.....	....	.....	.....	.....	.....	....	....	....	....	....	

*More than one date.

TABLE II.—*Climatological record of cooperative observers, August, 1906.*

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Alabama.	°	°	°	*Ins.*	*Ins.*
Alaga	.....	.....	.....	8.62	
Ashville	92	62	78.1	4.05	
Auburn	91	67	79.6	1.76	
Benton	.....	.....	.....	6.33	
Bermuda	100	64	80.7	4.49	
Boligee	100	66	84.3	2.76	
Bridgeport	.....	.....	.....	3.89	
Burkeville	.....	.....	.....	3.47	
Calera	.....	.....	.....	3.50	
Cedar Bluff	.....	.....	.....	5.60	
Citronelle	97	65	80.6	6.92	
Clanton	95	65	79.8	2.13	
Cordova	94	65	79.5	3.41	
Dadeville	.....	.....	.....	3.40	
Daphne	94	69	82.0	4.67	
Decatur	101	63	81.6	2.04	
Demopolis	.....	.....	.....	0.78	
Eufaula	94	68	79.8	3.51	
Evergreen	95	67	80.8	4.18	
Flomaton	96	64	81.0	4.20	
Florence	96	59	79.1	2.55	
Fort Deposit	99	61	81.8	2.03	
Gadsden	97	66	80.9	2.36	
Goodwater	100	62	81.9	5.14	
Greensboro	95	66	81.3	2.51	
Greenville	.....	.....	.....	2.80	
Guntersville	.....	.....	.....	2.91	
Hamilton	97	60	79.6	3.79	
Highland Home	98	56	80.8	1.45	
Letohatchie	.....	.....	.....	2.00	
Livingston	97	63	81.3	1.95	
Lock No. 4	95	64	79.6	5.16	
Lucy	95	66	80.6	6.18	
Madison Station	96	64	79.3	1.53	
Maplegrove	95	66	80.0	2.18	
Marion	98	67	84.0	1.71	
Milstead	.....	.....	.....	4.76	
Newbern	102	66	82.3	1.63	
Notasulga	.....	.....	.....	2.25	
Oneonta	94	60	77.6	11.23	
Opelika	94	65	80.8	1.88	
Ozark	98	67	81.4	1.72	
Prattville	95	65	80.4	4.67	
Pushmataha	99	65	81.0	4.12	
Riverton	95	55	77.7	1.46	
Scottsboro	91	62	77.9	6.86	
Selma	100	68	83.3	0.66	
Talladega	95	65	80.4	7.07	
Tallassee	.....	.....	.....	2.93	
Thomasville	95	62	80.4	6.98	
Tuscaloosa	98	67	81.6	3.08	
Tuscumbia	94	56	79.6	3.76	
Tuskegee	98	60	82.3	2.35	
Union Springs	95	67	82.0	3.01	
Uniontown	.....	.....	.....	1.95	
Valleyhead	96	59	76.4	3.73	
Alabama—Cont'd.	°	°	°	*Ins.*	*Ins.*
Vienna	.....	.....	.....	1.96	
Wetumpka	99	65	81.7	5.54	
Alaska.					
Killisnoo	68	45	53.9	4.90	
North Fork	72	36	57.3	1.01	
Sitka	65	43	55.0	4.66	
Arizona.					
Allaire Ranch	.....	.....	.....	3.90	
Alpine	.....	.....	.....	4.10	
Arizona Canal Co. Dam	108	65	87.0	5.29	
Aztec	115	68	90.0	0.76	
Benson	97	43	73.6	2.46	
Bisbee	84	52	69.0	2.75	
Blue	87	46	66.2	4.94	
Bonita	.....	.....	.....	3.40	
Bowie	97	55	76.8	2.82	
Casagrande	117	65	94.0	2.50	
Clifton	.....	.....	.....	4.64	
Cline	101	59	79.7	3.85	
Cochise[*1]	95	63	82.6	3.37	
Congress	102	65	81.7	2.47	
Douglas	95	54	76.0	4.80	
Dudleyville	98	60	78.8	5.41	
Duncan	99	48	74.8	2.16	
Fish Creek	.....	.....	.....	6.50	
Flagstaff	74	40	58.2	3.73	
Fort Apache	90	47	69.7	3.71	
Fort Huachuca	90	52	71.5	2.74	
Fort Mohave	116	65	90.8	2.70	
Fredonia	98	47	72.4	1.70	
Grand Canyon	95	37	62.0	5.10	
Greaterville	89	51	70.4	4.51	
Greer	.....	.....	.....	2.77	
Holbrook	98	46	72.2	1.25	
Huachuca Res	.....	.....	.....	6.49	
Jerome	94	56	75.0	4.20	
Keams Canyon	92	43	64.7	1.76	
Maricopa	112	65	88.0	3.10	
Mesa	110	64	87.0	4.07	
Mohawk Summit[*1]	116	78	91.9	3.05	
Natural Bridge	.....	.....	.....	5.53	
Nutrioso	.....	.....	.....	3.82	
Oracle	88	60	73.6	7.91	
Phoenix (Ex. Farm)	106	63	84.4	1.90	
Picacho[*b]	106	74	92.6	1.54	
Pinal Ranch	.....	.....	.....	4.17	
Pinto	.....	.....	.....	3.24	
Prescott	96	42	69.6	5.28	
Quakingasp	80	33	56.4	3.63	
Roosevelt	107	56	80.9	4.95	
St. Johns	91	46	69.0	3.34	
St. Michaels	87	40	66.0	2.08	
San Carlos	102	57	81.2	5.04	
San Simon	96	54	75.6	2.54	
Seligman	93	45	70.6	2.25	
Sentinel[*1]	116	72	91.4	6.53	
Arizona—Cont'd.	°	°	°	*Ins.*	*Ins.*
Signal	108	69	87.4	2.58	
Silver Bell	105	61	82.5	2.15	
Tempe	111	61	86.0	3.11	
Thatcher	101	52	78.8	2.14	
Tombstone	89	54	72.1	2.81	
Tuba	94	48	73.6	1.26	
Tucson	102	61	81.8	2.53	
Upper San Pedro	96	50	74.3	1.32	
Walnut Grove	.....	.....	.....	4.10	
Willcox	92	52	74.0	7.76	
Yarnell	.....	.....	.....	5.60	
Arkansas.					
Alicia	92	52	76.6	9.89	
Amity	92	51	77.8	3.70	
Arkadelphia	95	51	79.0	3.15	
Arkansas City	.....	.....	.....	3.16	
Arnett	86[b]	48[b]	72.2[b]	11.41	
Batesville	99[d]	53[d]	78.4[d]	9.01	
Beebranch	94	47	75.6	5.46	
Black Rock	.....	.....	.....	5.80	
Boonville	95	50	78.0	7.41	
Brinkley	98	53	80.0	6.20	
Calico Rock	.....	.....	.....	5.95	
Camden	94	51	78.4	1.54	
Center Point	95	52	80.0	5.62	
Clarendon	.....	.....	.....	5.45	
Conway	95	52	78.4	5.92	
Cornerstone	98	51	79.2	0.50	
Corning	94	52	77.1	6.62	
Dardanelle	.....	.....	.....	7.58	
Dodd City	94	44	75.8	3.80	
Dutton	88	45	71.4	9.52	
Eldorado	98	50	80.4	2.11	
Eureka Springs	92	47	75.0	9.47	
Fayetteville	95	47	75.8	6.96	
Forrest City	95	57	78.4	5.07	
Fulton	.....	.....	.....	1.70	
Hardy	95	52	76.4	8.67	
Harrison	97	42	74.2	4.65	
Heber	97	51	79.7	7.14	
Helena	95	57	79.8	2.48	
Hope	98	52	80.9	2.21	
Jonesboro	100	52	79.0	5.16	
Junction	99	48	79.4	1.00	
Lake Village	98	55	80.8	2.90	
Lewisville	98	51	80.6	1.28	
Lutherville	92	47	76.0	6.39	
Luxora	.....	.....	.....	4.00	
Malvern	94	52	78.1	4.50	
Mammoth Springs	93	48	76.2	6.72	
Marked Tree	.....	.....	.....	2.70	
Marvell	96	54	79.3	4.02	
Mena	90	52	76.2	9.38	
Montrose	98	52	80.2	1.26	
Mossville	87	53	73.1	5.58	
Newport	98	52	79.3	5.42	

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Arkansas—Cont'd.	°	°	°	*Ins.*	*Ins.*
Ozark	94	53	77.8	7.90	
Pinebluff	97	52	80.4	1.06	
Pocahontas	94[d]	47[d]	74.5[d]	8.80	
Pond	90	46	74.6	5.36	
Prescott	98	53	80.9	2.51	
Rison	97[e]	50[e]	79.5[e]	1.04	
Rogers	90	46	73.3	5.81	
Russellville	95	52	78.3	7.86	
Spielerville	93	.....	.....	7.08	
Stuttgart	95	53	78.8	5.04	
Texarkana	99	52	81.2	0.85	
Warren	100	52	81.3	3.32	
White Cliffs	.....	.....	.....	2.75	
Wiggs	95[f]	46[e]	77.5[f]	2.69	
Winchester	97	60	81.8	.....	
Witts Springs	95[e]	43[e]	72.5[e]	4.24	
California.					
Alturas	97	36	67.2	0.05	
Angola	110	40	80.6	0.00	
Auburn	100	56	79.2	0.00	
Azusa	102	45	72.4	0.03	
Bagdad	116	69	92.6	T.	
Bakersfield	110	55	82.5	0.00	
Bear Valley	.....	.....	.....	0.40	
Berkeley	85	52	61.6	0.04	
Bishop	97	45	71.8	0.55	
Blocksburg	97	40	67.6	0.00	
Blue Canyon	85	40	63.6	0.00	
Branscomb	93	38	67.4	0.00	
Brush Creek	102	44	71.6	T.	
Butte Valley	.....	.....	.....	T.	
Calexico	112	68	88.5	0.45	
Campbell	96	45	65.6	0.00	
Campo	.....	.....	.....	2.12	
Cedarville	103	39	71.5	0.42	
Chico	104	51	78.1	0.02	
Claremont	105	48	74.4	0.02	
Cloverdale	106	40	70.2	0.00	
Colfax	102	38	74.0	0.00	
Colusa	98	.....	.....	0.00	
Craftonville	.....	.....	.....	0.00	
Crescent City	72	39	54.5	0.00	
Crockers	.....	.....	.....	0.00	
Cuyamaca	83	42	63.9	3.00	
Delta	103	58	81.2	0.00	
Dobbins	110	56	80.0	0.00	
Drytown	.....	.....	.....	0.00	
Durham	105	50	78.1	0.00	
Elcajon	100	47	73.6	0.13	
Electra	105	55	80.6	0.00	
Elmwood	110	52	79.0	0.00	
Elsinore	110	42	76.0	T.	
Emigrant Gap	82	53	70.3	0.40	
Escondido	102	40	72.4	0.03	
Folsom	112	53	79.6	T.	
Fordyce	.....	.....	.....	0.05	
Fort Ross	69	45	56.8	0.00	
Georgetown	99	47	75.0	T.	
Gold Run	96	51	77.6	0.00	
Grass Valley	.....	.....	.....	0.23	
Greenville	98	36	67.4	0.74	
Groveland	.....	.....	.....	T.	
Hanford	109	40	76.2	0.00	
Healdsburg	110	40	70.2	0.00	
Heber	116	63	89.2	0.40	
Hollister	102	40	65.8	0.00	
Indio	116	67	90.5	1.07	
Idylwild	95	36	66.2	2.77	
Iowa Hill	95	48	75.0	0.03	
Isabella	.....	.....	.....	0.00	
Jamestown	102	51	76.8	0.00	
Kennedy Gold Mine	.....	.....	.....	0.00	
King City	.....	.....	.....	0.00	
Laporte	108	44	69.4	0.00	
Legrande	83	39	63.9	T.	
Lemoncove	108	50	80.9	0.00	
Lick Observatory	108	45	78.6	0.00	
Livermore	89	51	71.8	T.	
Lodi	106	49	71.8	0.00	
Lone Pine	101	49	72.6	T.	
Los Gatos	94	44	73.6	0.01	
Magalia	99	47	68.0	0.00	
Mammoth	99	40	70.4	0.04	
Marysville	124	52	92.6	0.40	
Mena	105	49	77.6	0.00	
Merced	112	64	88.2	2.60	
Mills College	109	52	80.5	0.00	
Milo	.....	.....	.....	0.00	
Milton (near)	.....	.....	.....	0.00	
Mohave	104	53	78.8	T.	
Mokelumne Hill	103	64	86.8	0.00	
Mono Ranch	100	50	76.6	T.	
Montague	96	43	68.1	T.	
Monterio	99	46	74.0	0.00	
Monumental	94	54	76.2	0.00	
Mount St. Helena	95	44	69.6	T.	
Napa	.....	.....	.....	0.00	
Needles	102	51	68.0	0.00	
	109	68	89.2	5.66	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
California—Cont'd.	°	°	°	*Ins.*	*Ins.*
Nellie	.....	.....	.....	1.39	
Nevada City	98	42	70.4	T	
Newcastle	104	48	77.9	0.00	
Newman	113	50	81.7	0.00	
Niles	94	50	67.1	T.	
Nimshew	98	62	82.6	0.00	
North Bloomfield	98	43	72.2	T.	
Oakland	84	52	62.5	0.00	
Ojai Valley	104	46	71.2	T.	
Orleans	111	48	80.7	0.00	
Oroville (near)	105	52	79.1	T.	
Ozena	.....	.....	.....	0.00	
Palermo	105	49	77.8	0.00	
Peachland	98	42	62.9	0.00	
Pine Crest	95	50	65.4	0.20	
Placerville	94	46	70.4	0.00	
Point Lobos	70	53	60.3	T.	
Porterville	107	54	81.2	0.00	
Poway	96	51	74.6	T.	
Quincy	91	37	65.4	0.43	
Redding	101	57	81.1	T.	
Redlands	108	49	77.7	0.04	
Reedley	110	52	81.8	T.	
Represa	.....	.....	.....	T.	
Rialto	110	52	77.2	0.02	
Riovista	99	52	73.2	T.	
Riverside	105	47	73.3	T.	
Rocklin	105	50	77.2	0.00	
Sacramento	94	50	70.5	T.	
Salinas	90	48	63.0	0.00	
Salton	106	65	84.1	0.00	
San Bernardino	111	46	76.4	T.	
San Jacinto	105	47	77.1	T.	
San Leandro	94	50	64.1	0.00	
Santa Barbara	90	52	66.3	0.04	
Santa Clara College	99	45	67.4	0.00	
Santa Cruz	96	46	62.6	0.00	
Santa Maria	82	50	63.6	0.01	
Santa Monica	76	52	64.2	.....	
Santa Rosa	100	40	66.6	0.00	
Shasta	109	54	84.0	0.00	
Sierra Madre	100	52	73.2	0.00	
Sisson	101	40	71.3	0.31	
Sonoma	98	48	65.6	0.00	
Sterling	94	44	70.3	0.00	
Stockton	101	48	73.6	T.	
Storey	106	48	78.0	0.00	
Summerdale	86	45	67.6	0.00	
Summit	83	58	74.0	1.00	
Susanville	90	42	68.1	0.77	
Tamarack	81	34	59.0	1.69	
Tejon	98	57	81.0	0.00	
Towle	94	43	70.8	T.	
Truckee	88	40	62.8	0.46	
Tulare	106	53	78.2	.....	
Ukiah	104	41	73.2	0.00	
Upland	100	50	72.4	0.00	
Upperlake	103	49	76.8	0.00	
Upper Mattole	.....	.....	.....	0.00	
Vacaville	107	44	73.8	0.00	
Wasco	110	55	80.8	0.00	
Westpoint	.....	.....	.....	0.04	
Wheatland	101	51	76.6	T.	
Willets	106	42	70.0	0.00	
Woodleaf	.....	.....	.....	T.	
Woodside	94	48	65.8	0.00	
Yosemite	96	42	70.2	0.98	
Zenia	90	42	67.2	0.00	
Colorado.					
Akron	.....	.....	.....	1.26	
Alamosa	84	36	61.4	0.71	
Antelope Springs	79	25	53.0	1.82	
Arriba	92	45	67.8	2.18	
Ashcroft	76	29	53.8	1.36	
Blaine	100	48	72.2	0.12	
Boulder	89	49	68.9	2.50	
Buena Vista	.....	.....	.....	1.82	
Burlington	98	42	71.0	2.02	
Canyon	94	47	72.1	1.42	
Calham	88	45	67.8	2.55	
Castlerock	99	41	68.5	0.63	
Cheesman	86	44	64.6	2.20	
Cheyenne Wells	96	44	71.6	2.39	
Clearview	72	35	53.6	3.47	
Collbran	92	38	66.6	0.78	
Colorado Springs	86	45	66.3	2.03	
Cripplecreek	.....	.....	.....	4.44	
Delta	97	43	72.2	0.60	
Dunkley	81	27	57.0	1.69	
Eagle	89	30	61.2	0.81	
Fort Collins	92	39	67.2	0.80	
Fowler	.....	.....	.....	0.90	
Frances	81	38	59.6	2.79	
Fruita	99	42	72.2	0.86	
Garnett	86	32	60.4	0.34	
Gleneyre	91	41	65.4	3.29	
Glenwood Springs	90	34	63.6	0.99	
Grand Valley	97	38	70.2	0.89	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Colorado—Cont'd.	°	°	°	*Ins.*	*Ins.*
Greeley	95	43	69.3	0.70	
Gunnison	84	30	58.6	1.14	
Hahns Peak	80	26	54.2	1.60	
Hamps	89	42	65.3	2.56	
Hoehne	97	40	68.6	0.84	
Holly	100	49	73.5	0.21	
Holyoke (near)	98	42	71.4	2.15	
Idaho Springs	83	42	60.8	2.19	
Lake City	88	37	59.0	2.07	
Lake Moraine	70	33	51.3	3.98	
Lamar	100	46	75.5	2.58	
Laporte	.....	.....	.....	1.30	
Las Animas	106	49	74.9	3.40	
Lay	89	29	62.6	1.33	
Leroy	95	40	70.1	2.83	
Longs Peak	75	27	52.3	1.39	
Lujane	89	46	68.8	0.78	
Manassa	81	36	60.4	0.19	
Mancos	87	39	63.7	0.92	
Meeker	86	32	62.3	1.17	
Montrose	91	39	65.4	1.68	
Moraine	81	31	58.0	1.49	
Pagoda	88	31	61.2	1.10	
Parvina	93	46	70.2	0.89	
Platte Canyon	.....	.....	.....	1.09	
Rangley	90	33	65.0	1.83	
River Portal	90	44	67.8	0.60	
Rockyford	.....	.....	.....	3.77	
Saguache	84	37	61.3	0.95	
Salida	87	37	61.2	1.28	
San Louis	82	36	60.4	1.63	
Santa Clara	83	41	61.6	2.56	
Sapinero	84	32	58.8	1.06	
Sheridan Lake	97	46	74.0	2.63	
Silt	88	42	66.9	1.20	
Silverton	76	31	53.0	2.72	
Stonewall	.....	.....	.....	2.42	
Sugar City	.....	.....	.....	4.90	
Trinidad	92	49	69.5	0.83	
Victor	78	39	59.0	4.30	
Vilas	.....	.....	.....	0.15	
Wagon Wheel	80	28	55.8	2.60	
Waterdale	91	40	66.6	1.35	
Westcliffe	84	33	60.0	0.89	
Whitepine	71	30	51.8	2.65	
Wray	96	44	71.7	3.57	
Yuma	.....	.....	.....	1.23	
Connecticut.					
Bridgeport	95	54	74.0	1.55	
Canton	93	45	70.6	3.19	
Colchester	90[e]	48[e]	70.8[e]	1.54	
Falls Village	.....	.....	.....	2.85	
Hawleyville	90	45	70.6	2.17	
Lake Konomoc	.....	.....	.....	2.51	
New London	90	54	73.0	2.10	
North Grosvenor Dale	91	46	71.4	1.96	
Norwalk	92	50	72.2	3.09	
Southington	91	47	71.7	1.90	
South Manchester	.....	.....	.....	3.27	
Storrs	89	49	70.5	2.16	
Voluntown	90	48	71.6	3.39	
Wallingford	91	54	72.8	2.52	
Waterbury	95	47	73.6	2.71	
West Cornwall	92	49	69.0	3.14	
West Simsbury	.....	.....	.....	1.80	
Delaware.					
Delaware City	.....	.....	.....	11.66	
Dover	93	59[d]	76.2[e]	4.12	
Milford	97	63	78.2	12.10	
Millsboro	95	66	78.2	11.34	
Newark	92	62	76.0	8.46	
Seaford	91	64	75.6	7.86	
Florida.					
Apalachicola	93	72	81.6	10.36	
Archer	96	70	81.5	.....	
Avon Park	94	70	81.3	9.56	
Bartow	97	71	82.3	4.73	
Bonifay	99	69	82.5	4.60	
Brooksville	95	70	81.2	7.42	
Clermont	99	71	82.7	4.43	
De Funiak	98	69	81.4	4.30	
Eustis	97	69	81.0	6.08	
Federal Point	96	69	81.5	8.60	
Fenholloway	97	69	81.6	.....	
Fernandina	96	73	81.4	4.45	
Fort Meade	98	70	81.8	17.53	
Fort Myers	92	70	79.8	12.02	
Fort Pierce	91	70	80.0	6.70	
Gainesville	98	71	82.8	4.49	
Galt	95	.....	.....	4.90	
Grasmere	96	71	82.3	.....	
Huntington	98	70	81.3	4.89	
Hypoluxo	92	71	81.4	7.47	
Inverness	93	70	81.0	5.95	
Jasper	95	70	81.6	9.74	
Johnstown	96[e]	69[e]	81.8[e]	3.67	
Kissimmee	95	72	82.0	2.59	
Lake City	96	71	82.1	3.92	

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Florida—Cont'd.	°	°	°	*Ins.*	*Ins.*
Macclenny	97	68	81.0	5.77	
Madison	100[c]	71[c]	83.2[c]	.....	
Malabar	95	69	81.9	4.04	
Manatee	94	68	80.8	13.12	
Marianna	99	69	81.6	6.63	
Merritt Island	92	72	81.6	3.47	
Miami	90	70	81.2	8.94	
Moline	97	62	79.7	4.66	
Monticello	94	70	80.4	11.35	
Mount Pleasant	98	.....	.....	7.05	
New Smyrna	96	68	80.9	8.73	
Ocala	98	69	82.0	5.49	
Orange City	.....	68	.....	6.93	
Orange Home	98	69	81.6	7.84	
Orlando	97	71	82.6	3.12	
Plant City	95	69	79.6	15.69	
Rockwell	97	70	82.0	11.02	
St. Andrew	94	69	81.8	6.09	
St. Augustine	96	71	80.5	2.01	
St. Leo	94	69	80.6	8.58	
Stephenville	98	70[f]	82.8[c]	10.58	
Switzerland	94[c]	70	81.0	5.04	
Tallahassee	92	69	79.6	10.12	
Tarpon Springs	95	68	80.6	20.99	
Wausau	99	69	82.5	6.10	
Georgia.					
Abbeville	.....	.....	.....	3.57	
Adairsville	90	61	78.4	2.97	
Albany	100	69	83.7	10.77	
Allapaha	98	68	82.0	6.85	
Americus	94	68	81.2	4.57	
Athens	89	66	78.2	3.08	
Bainbridge	100	65	81.6	7.08	
Blakely	99	.....	.....	9.21	
Bowersville	93	68	79.3	6.32	
Brunswick	102	72	83.0	5.95	
Butler	.....	.....	.....	5.55	
Camak	96	64	79.3	4.66	
Carlton	.....	.....	.....	4.84	
Carrollton	90	62	77.2	8.25	
Clayton	88	60	74.8	10.84	
Columbus	97[c]	70[c]	82.6[c]	4.84	
Cordele	96	65	79.8	4.87	
Covington	.....	.....	.....	4.52	
Cuthbert	101	66	81.8	7.67	
Dahlonega	91	.....	.....	7.56	
Dawson	98	69	82.9	4.73	
Diamond	86	59	73.6	11.22	
Dublin	.....	.....	.....	4.38	
Dudley	97	65	81.2	7.67	
Eastman	99	67	83.4	8.53	
Eatonton	97	65	80.8	5.05	
Elberton	95	65	80.0	3.18	
Experiment	93	65	79.0	6.48	
Fitzgerald	102	63	81.8	4.40	
Fleming	98	68	82.9	3.85	
Forsyth	99[c]	65[c]	82.3[c]	5.14	
Fort Gaines	93	70	81.2	3.90	
Gainesville	94	65	77.4	10.94	
Gillsville	92	65	78.0	7.55	
Glenville	96	68	81.8	12.81	
Greenbush	91	63	77.6	3.41	
Greensboro	96	65	80.8	7.37	
Griffin	95	64	79.8	8.66	
Harrison	95	67	80.8	5.94	
Hawkinsville	100	67	82.6	5.12	
Lost Mountain	93	62	78.7	5.22	
Louisville	95	62	81.7	7.22	
Lumpkin	95	65	79.8	2.10	
Marshallville	98	67	82.1	3.49	
Mauzy	99[c]	70[c]	82.1[c]	5.79	
Milledgeville	96	67	81.5	6.20	
Millen	99	68	82.8	3.67	
Montezuma	.....	.....	.....	5.14	
Monticello	95	65	80.7	6.49	
Morgan	93	68	80.7	4.63	
Newnan	95	65	80.7	6.49	
Point Peter	93	63	78.8	4.25	
Poulan	96	68	80.6	7.22	
Putnam	100	68	81.9	4.81	
Quitman	95	69	80.4	6.54	
Ramsey	90	60	77.0	4.71	
Resaca	.....	.....	.....	4.49	
Rome	95	63	80.3	4.63	
St. George	96	70	80.6	4.75	
St. Marys	98	68	81.6	5.29	
Screven	98	68	82.2	4.26	
Statesboro	98[f]	64[c]	81.6[f]	4.10	
Talbotton	96	65	80.0	6.88	
Tallapoosa	95	60	80.0	5.66	
Toccoa	89	63	75.8	4.18	
Valdosta	94	67	80.7	1.49	
Valona	96	70	80.6	6.84	
Washington	93	66	78.6	8.73	
Waycross	100	71	79.7	4.66	
Waynesboro	92	69	80.4	5.20	
Westpoint	94	67	79.6	5.04	
Woodbury	94	64	78.8	4.66	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Idaho.	°	°	°	*Ins.*	*Ins.*
American Falls	100	39	68.0	0.49	
Bannock River Cabin	94	37	65.8	1.23	
Blackfoot	99	37	66.4	1.02	
Buhl	100	46	72.0	0.31	
Caldwell	104	40	71.2	0.03	
Cambridge	107	43	73.2	0.12	
Chesterfield	93	25[i]	60.2[c]	3.01	
Dent	100	42	68.8	1.55	
Dewey	95	34	63.4	0.12	
Ellersilie	101	43	71.1	0.35	
Fernwood	.....	.....	.....	1.00	
Forney	100	27	60.4	1.40	
Garnett	106	50	77.3	0.26	
Hot Springs	101	48	73.0	0.77	
Idaho Falls	95	37	64.1	0.83	
Kellogg	97	35	63.8	1.01	
Lake	86	30	58.6	1.00	
Lakeview	88	42	63.9	0.85	
Landore	90	33	60.2	1.17	
Lardo	93	29	59.8	0.47	
Lost River	91	35	62.4	1.16	
Lovell	97	32	61.7	0.83	
Meadows	104	34	63.8	0.36	
Milner	102	41	70.6	0.17	
Minidoka	102	42	71.0	0.94	
Moscow	97	43	66.9	2.06	
Mountain Home	102	41	71.6	0.64	
Murray	96	33	61.4	1.26	
Nevens Ranch	.....	.....	.....	0.20	
Oakley	94	40	67.4	1.47	
Paris	88	32	60.7	2.63	
Pearl	.....	.....	.....	T.	
Pollock	104	49	72.0	1.35	
Poplars	.....	.....	.....	0.18	
Porthill	96	40	64.8	0.96	
Roosevelt	85	34	57.8	1.10	
St. Maries	99	36	65.7	0.63	
Salem	.....	.....	.....	1.14	
Salmon	97	38	65.0	1.57	
Standrod	.....	.....	.....	1.04	
Twin Falls	100	40	70.2	0.10	
Vernon	95	32	64.8	0.72	
Westlake	.....	.....	.....	1.37	
Weston	94	40	66.5	3.86	
Illinois.					
Albion	97	54	78.8	3.92	
Aledo	92	47	74.5	3.20	
Alexander	97	48	76.2	5.03	
Antioch	94	46	74.6	5.33	
Ashton	91	46	72.6	2.82	
Astoria	95	45	74.1	3.50	
Aurora	95	46	74.0	3.80	
Benton	98	48	78.7	2.67	
Bloomington	100	48	78.4	4.30	
Bushnell	98	47	77.0	1.32	
Cambridge	100	50	78.2	1.91	
Carlinville	98	48	77.2	5.86	
Carlyle	.....	.....	.....	2.65	
Carrollton	97[m]	55[m]	77.2[m]	.....	
Charleston	94	45	76.5	1.96	
Chester	98	60	80.2	4.62	
Cisne	101	49	79.4	3.68	
Coatsburg	98	48	75.9	5.68	
Cobden	94	51	77.4	5.07	
Colchester	98	48	77.0	2.02	
Decatur	94	48	76.8	5.35	
Dixon	95	47	74.8	2.09	
Dwight	95	46	75.8	1.85	
Equality	96	52	79.2	6.33	
Flora	97	50	76.4	4.76	
Friendgrove	94	55	77.2	4.89	
Galva	96	44	75.6	2.50	
Grafton	.....	.....	.....	4.26	
Greenville	95	52	77.7	2.03	
Griggsville	100	51	78.0	4.40	
Halfway	95	53	78.3	3.79	
Havana	99	49	78.6	3.51	
Henry	96	46	76.2	3.91	
Hillsboro	98	48	78.0	2.37	
Hoopeston	93	48	75.1	7.87	
Joliet	92	48	75.2	4.00	
Kishwaukee	94	39	73.4	6.91	
Knoxville	95	44	74.8	2.83	
Lagrange	96	50	75.8	5.53	
Laharpe	98	42	75.9	2.15	
Lanark	97	44	73.0	6.05	
Lincoln	97	50	77.8	2.72	
Loami	.....	.....	.....	3.81	
McLeansboro	97	54	78.4	4.35	
Martinsville	97	49	77.4	5.43	
Martinton	97	46	75.4	7.19	
Mascoutah	96	47	76.8	2.33	
Minonk	98	47	76.1	2.51	
Monmouth	98	48	76.6	1.98	
Morrison	91	46	73.2	2.91	
Morrisonville	95	46	75.9	3.34	
Mount Carmel	.....	.....	.....	5.82	
Mount Vernon	101	48	79.2	2.27	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Illinois—Cont'd.	°	°	°	*Ins.*	*Ins.*
New Burnside	95	49	77.8	4.88	
Olney	95	50	78.1	3.77	
Ottawa	95	.....	.....	4.57	
Palestine	95	52	77.6	9.97	
Pana	95	53	77.2	3.18	
Paris	96	47	77.1	3.27	
Peoria	97	53	77.6	1.63	
Philo	93	43	75.2	2.20	
Pontiac	95	50	77.0	0.80	
Rantoul	95	48	76.1	5.75	
Raum	93	54	77.2	5.10	
Riley	95	47	73.8	4.90	
Robinson	95	51	77.3	5.26	
Rockford	93	50	74.2	3.23	
Rushville	94	50	75.8	3.83	
St. Charles	98	45	75.2	3.55	
St. John	97	49[n]	76.8[c]	2.64	
Streator	97	45	76.3	2.25	
Sullivan	96	48	77.0	4.20	
Sycamore	95	41	74.1	3.34	
Tilden	97	46	77.5	4.42	
Tiskilwa	96	48	75.3	4.38	
Tuscola	92	48	75.4	4.68	
Urbana	94	47	75.3	4.57	
Vernon	98	48	77.6	4.00	
Walnut	96	48	76.8	3.07	
Warsaw	.....	.....	.....	4.38	
Windsor	95	46	76.7	3.41	
Winnebago	93	46	73.6	6.02	
Yorkville	94	45	74.5	3.90	
Zion	96	46	72.8	5.38	
Indiana.					
Anderson	93	51	75.2	5.33	
Angola	91	52	73.3	7.28	
Auburn	91[f]	48[d]	72.8[c]	3.99	
Bedford	94	63	78.4	3.70	
Bloomington	92	56	77.0	7.38	
Butlerville	94	51	77.2	3.53	
Cambridge City	95	47	74.8	3.79	
Columbus	97	50	76.8	4.99	
Connersville	93	47	74.9	4.34	
Crawfordsville	95[d]	44[d]	75.8[d]	3.73	
Delphi	96	45	75.4	4.19	
Elkhart	96	48	77.0	4.08	
Farmersburg	96	49	76.8	7.94	
Farmland	92	49	74.0	7.78	
Franklin	95[p]	50[p]	75.7[p]	4.76	
Greencastle	93	50	75.5	2.47	
Greenfield	92	51	76.0	6.08	
Greensburg	98	52[f]	77.0[c]	3.62	
Hammond	92	57	74.4	2.41	
Holland	97	54	79.0	6.90	
Huntington	96	49	75.5	6.43	
Jeffersonville	96	55	78.8	3.03	
Knox	90	47	74.4	3.18	
Kokomo	96	45	75.0	5.28	
Lafayette	93	47	75.9	6.40	
Laporte	94	44	73.6	4.65	
Lima	93	45	73.7	2.38	
Logansport	98	50	77.0	5.59	
Madison	98	54	79.4	3.00	
Marengo	95	52	77.2	2.53	
Marion	95	48	76.0	9.66	
Markle	94	46	73.8	5.50	
Mauzy	94	48	74.4	5.16	
Moores Hill	95	51	76.4	5.89	
Mount Vernon	98	55	80.2	3.49	
Northfield	93	43	73.7	3.75	
Paoli	98	53	78.2	5.15	
Plymouth	94	43	74.8	2.49	
Princeton	95	51	78.2	3.63	
Rensselaer	92	46	74.4	5.80	
Richmond	94	48	75.0	4.95	
Rochester	89	49	74.5	3.89	
Rockville	92	51	75.4	4.11	
Rome	96	55	79.0	4.15	
Salamonia	94	43	74.2	4.63	
Salem	95	52	78.0	4.77	
Scottsburg	93[b]	54[c]	78.6[b]	2.80	
Seymour	96	50	75.4	3.54	
Shelbyville	93	50	75.8	4.22	
South Bend	93	48	74.4	4.08	
Syracuse	96	44	75.6	2.04	
Terre Haute	93	52	77.6	6.98	
Veedersburg	94	50[c]	77.0	4.32	
Vevay	94	56	79.0	4.50	
Vincennes	97	53	79.3	4.59	
Washington	95	53	77.6	4.87	
Worthington	95	51	76.8	5.37	
Indian Territory.					
Ardmore	96	50	79.0	10.22	
Calvin	.....	.....	.....	13.15	
Durant	94	50	78.6	6.39	
Fairland	95	49	76.7	5.41	
Fort Gibson	.....	.....	.....	9.00	
Hartshorne	93	50	78.2	6.72	
Healdton	96	45	77.0	9.78	
Holdenville	91	53	76.8	14.85	

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Indian Territory—Cont'd.	°	°	°	*Ins.*	*Ins.*
Marlow	95	52	77.6	8.62	
Muskogee	93	52	77.0	9.17	
Okmulgee	97	53	77.7	6.61	
Pauls Valley	96	48	77.4	12.55	
Ravia	95	50	79.0	6.35	
Roff	96	53	78.2	6.52	
South McAlester	95	51	79.4	7.20	
Tulsa	94	54	77.6	5.25	
Vinita	95	49	76.5	2.36	
Wagoner	92	51	76.8	7.38	
Webbers Falls	97	53	78.1	6.04	
Iowa.					
Afton	97	45	75.4	3.63	
Albia	93	41	75.0	1.52	
Algona	93	45	72.0	8.88	
Allerton	99	42	76.7	0.92	
Alta	95	43	72.3	3.45	
Alton	96	41	72.0	5.31	
Amana	93	46	75.0	4.48	
Ames	94	43	73.8	5.28	
Atlantic	99	36	75.1	2.53	
Audubon	100	35	73.5	4.85	
Baxter	94	43	73.6	3.25	
Bedford	95	40	74.8	4.09	
Belleplaine	96	45	75.0	5.05	
Bloomfield	95	47	76.8	2.55	
Bonaparte	95	45	75.6	4.10	
Boone	95	46	74.4	3.11	
Britt	93	36	72.5	8.15	
Buckingham	.....	.....	.....	7.44	
Burlington	95	51	76.3	3.74	
Carroll	98	.....	73.6	2.65	
Cedar Rapids	96	48	76.4	6.03	
Chariton	97	44	74.6	4.84	
Clarinda	100	41	75.3	2.52	
Clearlake	98	48	73.2	7.09	
Clinton	94	46	75.0	5.07	
College Springs	95	41	74.4	5.83	
Columbus Junction	92	47	75.3	4.06	
Corning	96	37	74.0	1.15	
Corydon	97	45	76.0	4.36	
Creston	99	40	74.6	2.97	
Cumberland	.....	.....	.....	1.86	
Decorah	93	45	73.9	7.84	
Delaware	91	44	72.5	4.40	
Desoto	95	44	74.8	3.42	
Dows	93	40	72.2	3.36	
Earlham	95[e]	38[e]	73.2[e]	1.80	
Elkader	96	44	74.2	6.33	
Elliott	99	40	76.3	1.41	
Estherville	96	44	70.9	3.96	
Forest City	98	40	72.6	6.36	
Fort Dodge	95	45	74.4	5.60	
Fort Madison	.....	.....	.....	2.66	
Galva	93	36	72.0	3.55	
Gilman	.....	.....	.....	5.21	
Glenwood	93	45	74.0	2.10	
Grand Meadow	91	46	72.2	5.09	
Greene	94	42	73.3	3.65	
Greenfield	95	44	74.7	3.08	
Grinnell (near)	94	41	73.8	1.48	
Guthrie Center	94	40	74.2	2.68	
Hampton	97	46	74.4	4.26	
Hancock	95	44	74.2	2.25	
Harlan	94	38	73.0	2.91	
Hopeville	100	44	76.4	1.56	
Humbolt	92	44	72.0	5.58	
Idagrove	100	34	74.2	1.71	
Independence	93	45	72.8	2.20	
Indianola	96	45	75.4	5.52	
Inwood	98	42	71.4	7.21	
Iowa City	97	46	76.0	5.34	
Iowa Falls	92	42	72.3	3.61	
Jefferson	96	43	74.3	4.49	
Keosauqua	99	45	76.4	1.80	
Knoxville	94	45	75.2	3.17	
Lacona	.....	.....	.....	2.27	
Larrabee	95	43	72.7	4.22	
Leclaire	.....	.....	.....	2.27	
Lemars[b]	95	41	72.8	.....	
Lenox	94	45	74.7	2.04	
Leon	96	47	75.6	1.91	
Little Sioux	96	40	74.4	3.99	
Logan	96	50	74.6	2.80	
Maple Valley	.....	.....	.....	3.22	
Marshalltown	95	42	74.3	2.55	
Mason City	93	45	73.2	5.54	
Massena	.....	38	.....	1.86	
Mountayr	97	46	76.5	2.36	
Mount Pleasant	96	47	76.6	3.01	
Muscatine	.....	.....	.....	2.32	
Nevada	.....	.....	.....	3.76	
New Hampton	89	44	71.4	2.30	
Newton	92	55	75.0	1.83	
Northwood	91[d]	.....	73.1[d]	5.65	
Odebolt	101	40	75.4	2.38	
Ogden	95	43	73.4	4.32	
Olin	91	44	73.5	7.46	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Iowa—Cont'd.	°	°	°	*Ins.*	*Ins.*
Onawa	96	46	74.8	7.71	
Osage	96	45	72.4	3.21	
Oskaloosa	93	45	74.9	2.42	
Ottumwa	98	47	77.4	1.33	
Pacific Junction	95	40	73.7	1.90	
Pella	95	47	76.4	3.95	
Perry	94	43	75.0	3.84	
Plover	95	51	73.6	5.50	
Pocahontas	95	43	73.4	2.87	
Preston	91	45	73.1	8.45	
Ridgeway	96	45	74.4	3.93	
Rock Rapids	98	44	72.0	3.65	
Rockwell	95	43	73.6	6.83	
Sac City	93	40	71.6	1.69	
St. Charles	95	47	76.1	2.31	
Sheldon	97	40	73.0	5.25	
Sibley	97	41	69.9	10.51	
Sigourney	94	44	75.2	2.52	
Sioux Center	94	45	71.2	5.77	
Stockport	95	46	76.1	2.10	
Thurman	94	41	74.6	4.87	
Tipton	95	50	77.2	3.86	
Toledo	94	43	74.5	5.60	
Wapello	.....	.....	.....	3.06	
Washington	93	46	75.1	2.98	
Washta	100	33	73.0	2.19	
Waterloo	95	45	74.8	2.87	
Waukee	92[d]	45[d]	74.4[d]	3.81	
Waverly	93	45	73.8	2.50	
Webster City	97	48	74.9	2.11	
Westbend	95	42	71.6	6.79	
Whitten[c]	91	42	73.1	.....	
Wilton Junction	91[c]	47	74.3[d]	2.64	
Winterset	93	45	75.6	1.92	
Woodburn	92	40	73.8	5.55	
Zearing	93	39	73.4	2.40	
Kansas.					
Abilene	.....	.....	.....	3.36	
Alton	103	43	78.2	2.28	
Anthony	.....	.....	.....	6.45	
Atchison	96	51	76.6	5.04	
Baker	95	44	75.7	10.91	
Burlington	97	45	77.6	2.42	
Chapman	99	44	78.0	3.93	
Cimarron	97	45	74.2	4.42	
Clay Center	98	38	77.4	4.16	
Colby	101	45	73.6	2.62	
Coldwater	98	50	76.6	1.84	
Coolidge	105	47	76.0	1.91	
Cunningham	97	43	76.5	6.63	
Dresden	102	47	75.2	1.89	
Eldorado	93	44	76.2	6.27	
Ellinwood	96	46	75.8	2.28	
Ellsworth	98	44	76.6	4.05	
Emporia	95	46	76.7	3.06	
Englewood	97	49	77.6	4.22	
Enterprise	95	44	76.6	2.62	
Eureka	.....	.....	.....	3.77	
Fall River	93	46	76.2	3.58	
Farnsworth	101	44	75.3	2.16	
Forsha	93	45	76.0	7.82	
Fort Scott	96	46	77.1	3.43	
Frankfort	100	43	75.8	4.37	
Fredonia	94	47	76.2	3.23	
Garden City	102	45	77.2	1.50	
Garnett	96	45	77.4	3.83	
Goodland	99	42	72.8	2.03	
Gove[a1]	100	50	74.6	2.84	
Grenola	93	46	75.7	4.60	
Hanover	98	44	77.2	5.90	
Harrison	98	37	75.6	1.76	
Hays	101	36	75.6	2.87	
Horton	98	48	76.4	7.10	
Hoxie	103	.....	.....	3.30	
Hugoton	100	45	76.2	0.40	
Hutchinson	94	46	76.4	7.85	
Independence	97	50	78.8	5.23	
Jetmore	100	44	76.8	2.46	
Jewell	.....	37	.....	1.06	
La Crosse	100	43	76.4	3.19	
Lakin	99	41	73.4	0.87	
Larned	98	39	75.0	5.05	
Lebanon	98[d]	47[d]	76.8[d]	T.	
Lebo	95	46	76.1	3.73	
McPherson	98	45	78.4	2.99	
Macksville	93	44	74.4	9.22	
Manhattan *b*	100	45	78.4	6.37	
Manhattan *c*	99	43	77.2	6.22	
Medicine Lodge	99	46	77.4	6.36	
Minneapolis	99	45	77.2	1.97	
Moran	95	48	77.0	3.74	
Mounthope	.....	.....	.....	3.28	
Neosho Rapids	.....	.....	.....	4.08	
Ness City	99	50	76.1	4.11	
Newton	96	44	76.6	5.84	
Norton	101	50	76.1	1.80	
Norwich	94	49	77.3	9.13	
Oberlin	.....	.....	.....	2.90	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Kansas—Cont'd.	°	°	°	*Ins.*	*Ins.*
Olathe	91	49	75.0	7.91	
Osage City	98	42	76.4	2.67	
Oswego	94	45	76.3	3.07	
Ottawa	94	45	75.2	5.41	
Plainville	98	46	74.6	1.35	
Pleasanton	92	50	75.8	4.30	
Pratt	96	47	76.4	3.53	
Republic	96	40	75.6	1.69	
Rome	97	45	77.0	8.67	
Russell	99	45	76.2	2.40	
Salina	99	38	77.6	2.30	
Scott	102	44	75.4	1.51	
Toronto	97	45	76.3	2.91	
Tribune	.....	.....	.....	2.82	
Ulysses[d]	102	47	76.8	.....	
Valley Falls	93	46	75.2	5.75	
Wakeeney	102	47	75.6	3.82	
Wakeeney (near)	.....	.....	.....	3.53	
Wallace	101	47	74.4	1.95	
Walnut	95	50	78.0	4.29	
Wamego[a1]	93	50	75.8	5.79	
Winfield	93	45	76.4	4.49	
Yates Center	95	47	77.0	3.44	
Kentucky.					
Alpha	90	62	76.2	5.19	
Anchorage	95	51	77.0	3.88	
Bardstown	98	55	79.4	3.36	
Beattyville	96	60	78.2	5.70	
Beaver Dam	95	54	78.4	4.19	
Berea	95	57	77.7	4.28	
Blandville	90	56	77.0	3.28	
Bowling Green	94	56	78.8	4.19	
Burnside	94	60	75.7	5.25	
Cadiz	96	54	78.6	3.13	
Calhoun	97	55	79.0	4.21	
Catlettsburg	92	58	77.6	4.20	
Earlington	94	45	76.5	4.26	
Edmonton	94	56	77.2	6.24	
Eubank	92	57	76.6	2.50	
Falmouth	.....	.....	.....	8.96	
Farmers	93	55	77.2	4.24	
Frankfort	90	56	76.8	4.69	
Franklin	95	56	78.4	4.25	
Greensburg	95	54	77.4	5.29	
High Bridge	98	55	79.2	3.37	
Hopkinsville	95	53	78.4	4.47	
Irvington	92	56	77.8	3.43	
Jackson	97	62	79.4	3.56	
Leitchfield	90	56	76.2	6.68	
Loretto	96	53	77.9	4.82	
Lynnville	96	54	77.8	6.86	
Manchester	95	63	78.6	4.71	
Marion	93	55	78.0	3.96	
Maysville	99	53	78.7	2.11	
Middlesboro	93	62	77.6	3.92	
Mount Sterling	93	58	77.2	6.23	
Owensboro	91	58	77.8	5.92	
Owenton	94	54	76.4	3.06	
Paducah	98	59	80.5	2.72	
Richmond	93	59	77.4	3.08	
St. John	93	53	75.4	2.40	
Scott	94	53	77.1	4.37	
Shelby City	95	53	75.9	3.00	
Shelbyville	96	51	77.5	4.03	
Taylorsville	91	55	76.5	6.29	
Williamsburg	91	61	76.4	4.26	
Williamstown	92	55	76.2	5.47	
Louisiana.					
Abbeville	98	61	82.2	4.54	
Alexandria	105	56	84.8	0.69	
Amite	100	64	82.0	2.33	
Baton Rouge	99	62	82.6	1.08	
Burnside	96	63	81.0	1.34	
Calhoun	100	52	80.9	0.71	
Cheneyville	98	55	81.9	1.47	
Clinton	96	60	80.2	4.34	
Collinston	100	55	82.4	1.86	
Crowley	.....	.....	.....	2.66	
Covington	99	65	81.6	4.01	
Donaldsonville	98	66	82.8	2.76	
Farmerville	98	52	81.0	0.70	
Franklin	99	63	82.6	4.49	
Grand Coteau	98	58	82.0	1.65	
Houma	99	65	82.0	5.30	
Jennings	95	60	81.6	4.24	
Lafayette	96	58	81.6	2.24	
Lake Charles	99	60	83.0	3.01	
Lakeside	95	64	82.3	1.39	
Lawrence	100	71	83.6	5.82	
Libertyhill	101	52	81.2	1.29	
Logansport	.....	.....	.....	3.31	
Melville	99	57	81.2	1.60	
Minden	100	53	82.2	2.33	
Monroe	102	58	84.0	1.80	
Morgan City	.....	.....	.....	4.84	
Opelousas	97	56	82.0	1.76	
Plain Dealing	99	52	81.8	0.82	
Rayne	97	58	81.5	2.65	

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Louisiana—Cont'd.	°	°	°	*Ins.*	*Ins.*
Reserve	100	64	83.2	2.45	
Robeline	96	52	80.6	0.58	
Ruston	103	55	82.6	2.40	
St. Francisville	101	63	83.6	0.25	
Schriever	100	63	83.0	6.38	
Simmesport				3.86	
Sugar Experiment Station	94	71	82.2	7.44	
Sugartown	96	58	80.6	2.12	
Maine.					
Bar Harbor	94	41	67.3	0.75	
Chesencook				0.91	
Cornish	95	46	70.6	1.92	
Danforth				2.79	
Debsconeag	98[4]	45[4]	69.2[4]	3.16	
Fairfield	93	45	70.1	4.78	
Farmington	93	41	67.6	2.42	
Fort Fairfield	99	36	65.2	1.75	
Gardiner	93	42	69.4	1.21	
Grant Farm				1.74	
Greenville	96	40	65.8		
Houlton	95	36	65.2	1.50	
Lewiston	97	50	72.2	0.80	
Madison	90	41	66.7	2.02	
Mayfield	91	43	67.2	4.18	
Millinocket	102	39	69.8	1.90	
North Bridgton	94	46	70.8	1.79	
Oquossoc	93	40	72.0	1.33	
Orono	95	39	69.0	1.69	
Patten	96	35	65.9	1.57	
Rumford Falls	94	44	69.4	3.47	
The Forks				2.57	
Vanburen	100	35	65.8	6.00	
Winslow	93	41	68.9	2.96	
Maryland.					
Annapolis	94	66	78.0	8.87	
Bachmans Valley	91	61	74.8	10.60	
Cambridge	96	64	78.8	10.62	
Cheltenham	92	62	76.2	7.40	
Chestertown	90	62	76.2	8.81	
Chewsville	94	58	74.8	4.82	
Clearspring	89	58	72.8	9.76	
Coleman	93	62	76.8	6.59	
Collegepark	96[3]	61[4]	77.0[3]	9.34	
Cumberland				8.54	
Darlington	92	61	74.5	8.91	
Deerpark	85	47	69.7	3.38	
Easton	89	63	76.0	4.71	
Fallston	92	59	74.6	5.94	
Frederick	92	60	76.0	7.73	
Frostburg				8.08	
Grantsville	85	51	69.7	9.46	
Great Falls	95	63	76.5	8.89	
Greenspring Furnace	90	54	74.2	9.25	
Harney				8.35	
Jewell	90	66	76.3	7.53	
Johns Hopkins Hospital				6.85	
Keedysville	94	60	76.0	8.70	
Lake Montebello	94	62	75.6	6.12	
Laurel	93	60	76.4	11.21	
Monrovia	92	58	75.4	12.22	
Mount St. Marys College	91	56	74.2	7.01	
Oakland	85	48	70.0	2.98	
Pocomoke City	93	68	79.0	4.75	
Porto Bello	93	66	79.5	6.98	
Princess Anne	89	64	76.9	9.33	
Salisbury	93	63	78.2	9.04	
Solomons	92	67	78.4	8.91	
Takoma Park	92	60	75.0	9.05	
Taneytown	92	59	74.6	8.95	
Van Bibber	91	62	75.7	6.97	
Westernport	92	54	74.4	8.41	
Woodstock	91	64	77.2	9.12	
Massachusetts.					
Amherst	90	48	71.2	6.42	
Bedford	87	48	69.9	3.47	
Bluehill (summit)	90	53	70.4	2.06	
Cambridge	92	52	72.6	1.66	
Chestnuthill	94	49	73.4	1.82	
Concord	91	47	70.0	3.86	
East Templeton[1]	89	54	69.6	3.44	
Fallriver	86	52	70.8	2.61	
Fitchburg	92	47	71.0	3.00	
Framingham	92	44	70.8	2.64	
Groton	90	45	69.6	2.07	
Hyannis	84	55	71.1	1.07	
Jefferson				4.55	
Lawrence	92	50	72.2	1.66	
Leominster				3.19	
Lowell	91	50	74.0	3.47	
Middleboro	89	46	70.9	3.49	
Monson	90	46	70.3	2.16	
New Bedford	89	55	72.9	2.26	
Plymouth	90	49	69.8	2.53	
Princeton				5.48	
Provincetown	88	56	70.6	1.92	
Somerset[1]	97	54	74.2	2.89	
Sterling				4.54	
Taunton	89	47	70.8	1.60	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Massachusetts—Cont'd.	°	°	°	*Ins.*	*Ins.*
Webster				1.66	
Westboro	91	47	72.4	4.88	
Weston	90	46	69.8	3.46	
Winchendon				3.37	
Worcester	93	53	73.0	2.14	
Michigan.					
Adrian	95	48	73.8	5.22	
Agricultural College	92	51	73.5	4.35	
Allegan	94	45	75.9	3.30	
Alma	91	43	71.6	2.78	
Ann Arbor	93	49	73.5	2.82	
Arbela	96	46	74.6	1.10	
Ball Mountain	90	49	71.2	4.64	
Baraga				2.27	
Battlecreek	95	44	73.6	1.19	
Bay City	95	49	73.1	4.95	
Berlin	96	42	71.2	2.05	
Big Rapids	90	43	69.6	4.69	
Bloomingdale	94	45	74.0	3.25	
Calumet	85	44	65.2	4.88	
Carsonville	92	46	71.4	1.99	
Cassopolis	91	45	74.6	3.20	
Charlevoix	90	48	72.6	1.06	
Charlotte	94	45	72.6	3.82	
Chatham	89	37	63.8	4.13	
Cheboygan	94	44	70.8	1.71	
Clinton	92	48	72.0	2.52	
Coldwater	93	46	72.8	5.17	
Concord	90	48	72.0	1.60	
Deer Park	92	44	64.2	1.50	
Detour	85	48	67.6	1.36	
Dundee	90	49	72.4	3.31	
Eagle Harbor	88	44	62.4	5.81	
East Tawas	89[1]	42[1]	67.2[1]	2.04	
Eloise	92	50	73.4	2.27	
Fenville	91	45	73.0	2.64	
Flint	93	46	72.4	0.94	
Grand Marais	87	46	63.8	2.08	
Grape	91	49	72.2	2.84	
Grasslake	92	47	72.6	2.88	
Grayling	87[3]	35[3]	66.4[3]	1.10	
Hagar	93	41	72.4	1.04	
Harbor Beach	92	48	71.5	2.65	
Harrison	93	45	70.2	2.65	
Harrisville	91	46	69.3	2.92	
Hastings	93	44	72.8	3.65	
Hayes	93	45	72.3	2.33	
Highland	96	40		2.57	
Hillsdale	90	48	72.0	5.46	
Holland	94	45	75.0	1.49	
Howell	91[4]	46[4]	72.2[4]	3.07	
Humboldt	90	31	61.6	1.75	
Iron Mountain	90	40	67.0	2.75	
Iron River	92	33	65.2	6.95	
Ironwood	93	41	66.6	5.66	
Ishpeming	86	32	61.8	4.27	
Isle Royal	79	46	61.0	4.09	
Ivan	95	41	70.5	1.20	
Jackson	96	50	75.2	1.97	
Jeddo	92	48	72.4	3.40	
Lansing	92	47	73.0	5.14	
Ludington	91	50	71.5	0.90	
Mackinac Island	86	54	70.0	1.80	
Mackinaw	88	54	70.0		
Maple Ridge	89	38	64.7	3.55	
Marlboro	92	42	71.0	9.40	
Menominee	90	47	69.2	3.46	
Mio	88	38	66.4	2.44	
Montague	93	48	73.4	4.68	
Mount Clemens	95	47	72.5	2.91	
Muskegon	89	48	71.6	2.69	
Newberry	90			1.90	
Old Mission	91	50	70.8	1.15	
Olivet	89	50	72.5	2.76	
Omer	93	39	69.0	3.86	
Onaway	94	40	67.2		
Ovid	95	42	72.8	1.83	
Owosso	93	42	72.1	1.20	
Petoskey	86			1.30	
Plymouth	94	44	72.4	1.65	
Powers	89	39	65.6		
Reed City	92	48	72.0	4.00	
Saginaw (W. S.)	94	46	72.9	4.15	
St. James	84	52	69.2	3.78	
St. Joseph	92	54	74.2	0.87	
Slocum	92	41	71.0	1.90	
South Haven	88	45	70.4	1.90	
Stanton	92	40	71.2	2.75	
Thomaston	92	32	65.1		
Thornville	91	48	72.7	3.37	
Traverse City	91	49	70.4	0.82	
Vassar				2.50	
Wasepi	89	46	72.2	3.23	
Webberville	91	45	71.8	5.45	
Wetmore	94	34	64.3	1.50	
Whitefish Point	82	43	63.2	0.92	
Woodlawn	90	35	65.7	3.64	
Ypsilanti	92	44	72.8	3.58	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Minnesota.	°	°	°	*Ins.*	*Ins.*
Albert Lea	95	43	72.0	7.35	
Alexandria	92	44	67.4	5.15	
Amboy	97	44	72.0	4.41	
Angus	93	34	65.6	3.88	
Ashby	89	43	67.1	3.92	
Bagley	93	33	64.1	4.51	
Beardsley	98	44	68.0	6.71	
Beaulieu	93	37	65.6	2.72	
Bird Island	93	44	70.2	6.48	
Caledonia	89	48	71.2	4.34	
Campbell	92	40	66.8	5.91	
Cass Lake				2.63	
Collegeville	92	46	68.8	3.39	
Crookston	92	39	66.5	2.92	
Detroit	90	35	64.8	3.29	
Faribault	93	42	70.7	6.63	
Farmington	92	46	70.8	3.49	
Fergus Falls	93	43	68.8	4.80	
Fort Ripley	92	40	71.4	5.64	
Glencoe	94	46	71.2	6.15	
Grand Meadow	92	42	71.4	5.23	
Hallock	94	34	65.6	1.81	
Halstead	95	36	65.8	3.11	
Hinckley	95	37	67.2	3.21	
International Falls	91	27	64.2	0.53	
Leech	90	31	62.0	5.69	
Little Falls	95	43	69.2	5.31	
Long Prairie	90	42	67.4	6.13	
Luverne	95	41	70.0	4.14	
Lynd	102	43	69.8	5.77	
Mankato				6.10	
Milaca	93	36	66.8	2.68	
Milan	95	41	68.7	8.15	
Minneapolis	94	44	70.9	3.76	
Montevideo	96	44	70.8	5.05	
Mora	94	38	67.4	3.75	
Morris	93	44	68.4	5.40	
Mount Iron	89	31	63.8	3.14	
New London	100	46	70.3	3.90	
New Richland	96	44	72.2	4.46	
New Ulm	96	45	72.6	6.66	
Park Rapids	95	38	66.1	10.13	
Pine River	90	38	66.3	4.45	
Pipestone	92	41	69.0	4.87	
Pokegama Falls	92	32	64.8	4.53	
Redwing				4.30	
Reeds				5.44	
St. Charles	96	42	72.0	3.06	
St. Cloud	95	43	68.5	3.42	
St. Peter	96	41	70.2	7.88	
Sandy Lake Dam	90	40	67.2	4.00	
Shakopee	91	45	71.2	8.80	
Stillwater				2.32	
Tonka				5.22	
Two Harbors	93	38	66.2	3.38	
Wabasha	99	45	73.8	4.24	
Wadena	92	40	66.6	5.03	
Willow River	100	37	66.6	5.31	
Windom	99	43	71.0	5.31	
Winnebago	101	43	72.4	4.94	
Winnibigoshish	92	38	66.0	4.31	
Winona	91	48	71.8	3.80	
Worthington	96	44	69.4	4.05	
Mississippi.					
Aberdeen	100	58	81.4	2.33	
Agricultural College		62		1.09	
Austin	96	56	78.6	4.07	
Batesville	97	57	80.0	4.39	
Bay St. Louis	97	70	82.4	4.08	
Bellefontaine	97	55	80.2	2.77	
Biloxi	97	70	83.8	2.96	
Booneville	92	58	77.8	1.14	
Brookhaven	101	61	81.8	3.95	
Canton	98	58	80.6	2.01	
Columbia				3.00	
Columbus	97	62	80.8	4.36	
Corinth	92	56	78.5	2.86	
Crystal Springs	98	60	81.6	1.81	
Duck Hill	99	56	80.2	5.38	
Edwards	98	58	80.6	1.79	
Enterprise				6.78	
Fayette	93	55	78.5	4.11	
Fayette (near)				2.59	
Greenville	95	57	80.4	2.24	
Greenwood	95	58	79.6	3.19	
Hattiesburg	101	65	82.2	3.08	
Hazlehurst	100	60	81.8	0.90	
Hernando	96	54	79.3	1.63	
Holly Bluff				1.77	
Holly Springs	96	56	79.5	1.09	
Jackson	101	58	82.0	0.75	
Kosciusko	99	58	80.8	1.25	
Lake	97	58	79.8	3.67	
Lake Como	101	60	82.0	0.77	
Laurel	98	63	80.6	2.41	
Leakesville	99	62	81.8	3.79	
Louisville	96	63	80.8	1.37	
McNeill	100	67	83.1	4.43	

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Mississippi—Cont'd.	°	°	°	*Ins.*	*Ins.*
Macon	98	62	80.2	0.86	
Magnolia	100	62	82.0	4.71	
Merrill				3.70	
Natchez	99	58	82.1	2.47	
Nitta Yuma	97	65	82.4	1.79	
Okolona	100	60	81.7	1.96	
Pearlington	98	69	81.2	3.69	
Pittsboro	97	56	78.0	3.32	
Pontotoc	92	57	77.8	0.82	
Port Gibson	100	54	80.8	3.81	
Porterville	99	62	80.6	3.55	
Quitman	98			3.73	
Ripley	95	51	78.0	5.08	
Shoccoe	100	58	81.1		
Shubuta				4.93	
Stonington				1.70	
Suffolk	99	57	81.1	3.70	
Tchula	99	57	80.8	4.31	
Tupelo	98	56	80.1	2.21	
University	100	55	79.9	3.11	
Utica	96	58	80.8	1.95	
Walnutgrove	93[d]	59[d]	79.2[d]	3.06	
Watervalley	98	56	81.0	2.05	
Waynesboro	96	65	79.8	3.85	
Woodville	99	59	82.1	3.39	
Yazoo City	96	59	80.8	3.08	
Missouri.					
Albany				3.45	
Appleton City	96	48	77.6	4.46	
Arthur	94	46	75.8	3.29	
Avalon	98	48	77.6	4.41	
Belle	93	45	75.0	3.79	
Bethany	94	43	74.6	3.61	
Birchtree	94[g]	50[g]	75.0	6.37	
Bolivar	93	45	74.8	2.04	
Boonville				4.96	
Brunswick	97	50	77.0	5.33	
Caruthersville	96	54	78.0	6.30	
Conception	98	49	75.8	1.79	
Dean	94	47	75.5	5.20	
De Soto	97	47	78.4	2.06	
Doniphan	93	49	76.2	7.91	
Eldorado Springs	93	46	75.6	4.72	
Fairport				5.80	
Fayette	95	49	75.5	3.98	
Fulton	98	45	77.2	3.71	
Gads Hill	96	46	76.4	4.04	
Gallatin [e]	100	54	78.3	4.50	
Gano	93	45	75.1	6.95	
Glasgow				2.84	
Goodland	90	43	73.5	4.76	
Gorin				4.28	
Grant City	96	49	75.6	6.38	
Harrisonville	96	50	77.2	5.08	
Hazlehurst				3.22	
Hermann				1.32	
Houston	92	44	73.8	3.98	
Ironton	97	40	75.4	4.07	
Jackson	99	51	80.2	3.94	
Jefferson City	96	46	76.4	3.01	
Kidder	101	46	77.0	2.74	
Koshkonong	93	51	75.8	4.23	
Lamar	93	47	76.3	4.67	
Lamonte				3.57	
Lebanon	90	48	74.6	5.35	
Lexington	97	49	77.2	2.71	
Liberty	93	52	76.5	3.26	
Lockwood	90	49	74.8	10.85	
Louisiana	99	40	76.2	2.52	
Macon	97	48	77.0	4.20	
Marblehill	94	48	76.6	7.06	
Marshall	94	46	75.8	3.96	
Maryville	97	45	75.5	2.96	
Mexico	97	44	75.8	2.76	
Monroe	95	49	75.0	9.62	
Mountain Grove	89	45	73.0	4.94	
Montgomery	94	46	75.9	2.06	
Neosho	92	45	74.8	5.45	
New Haven	95	50	77.4	5.24	
New Madrid				4.54	
New Palestine	98	50	77.6	2.73	
Oakfield	94	53	77.2	6.91	
Olden	93	43	73.2	3.43	
Oregon	96	49	75.7	4.37	
Osceola				3.37	
Princeton	101	48	79.8	1.83	
Rockport				4.18	
Rolla				4.92	
St. Charles	95	51	77.2	5.63	
St. Joseph				5.06	
Sarcoxie				10.54	
Sedalia	94	49	76.2	5.84	
Seymour	89	44	70.9	5.66	
Sikeston	94	51	77.2	3.58	
Steffenville	97	53	76.8	7.70	
Sublett	97	45	76.2	4.34	
Trenton	93	49	77.0	4.14	
Unionville	97	46	76.8	3.97	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Missouri—Cont'd.	°	°	°	*Ins.*	*Ins.*
Versailles	96	45	75.8	5.06	
Warrensburg	98	49	77.7	4.31	
Warrenton	96	50	77.4	2.41	
Warsaw	98	47	76.6	12.43	
Wheatland				4.84	
Willowsprings	93	42	70.8	5.71	
Windsor	94	47	75.6	6.36	
Montana.					
Absarokee				2.95	
Adell	94	36	59.8	2.62	
Anaconda	96	37	63.4	1.73	
Augusta	93	31	60.2	2.18	
Babb	90	33	57.8	3.30	
Bear Creek	89°	30°	56.4°	2.60	
Billings	105[i]	48[i]	75.0[i]	2.99	
Butte	90	38	62.3	2.20	
Canyon Ferry	96	41	65.6	2.86	
Cascade	94	38	63.4	3.15	
Chester	98	42	66.9	1.60	
Chinook	101	38	68.2	1.83	
Choteau	97[d]	39[d]	62.5[d]	2.75	
Clear Creek	98	37	64.8	2.10	
Columbia Falls	97	33	62.7	2.51	
Copper				2.21	
Crow Agency	100	37	67.9	2.67	
Culbertson	100	38	66.2	1.99	
Dayton	95	40	63.4	2.79	
Decker	101	32	66.8	1.46	
Dillon	89	31	61.9	3.17	
Ekalaka	106	40	68.4	3.08	
Ericson				2.68	
Evans	96°	37°	63.0°	2.64	
Fallon	105	43	68.4	2.89	
Forsyth	104	37	69.3	1.45	
Fort Benton	102	42	68.2	1.40	
Fort Harrison	95	40	66.2		
Glasgow	94	35	66.2	1.26	
Glendive	94[g]	45[g]	67.4[g]	2.87	
Gold Butte				3.09	
Graham	107	36	67.6	3.57	
Grave Creek Cabin	92	29	59.6	1.15	
Grayling	85	23	53.0	1.40	
Greatfalls	96	44	65.4	2.66	
Highwood				2.55	
Homepark				2.00	
Huntley	102	40	70.1	2.32	
Jordan	100	35	63.4	0.30	
Lakeview				3.80	
Lame Deer	102	32	66.4	1.96	
Lewistown	98[f]	32	64.0	0.60	
Livingston	97	34	66.0	2.56	
Lodge Grass	98[f]	33[f]	65.3[f]	2.10	
Malta	100	40	68.6	1.12	
Marion	92	29	57.2	2.30	
Marysville	91	28	60.7	2.73	
Missoula	99	35	66.2	1.76	
Mullets Ranch				3.59	
Nye				2.91	
Ovando	96	31	60.4	1.17	
Philipsburg	93	34	61.0	1.65	
Plains	97	42	65.2	2.37	
Plentywood	108	30	68.5	0.12	
Poplar	100	39	63.8	2.04	
Raymond				2.76	
Redlodge	90	35	60.6	2.83	
Renovo	95	33	63.1	1.88	
Saltese				2.10	
Springbrook	99	41	68.0	2.45	
Steele	100	40	66.8	1.39	
Tokna	104	44	69.0	4.07	
Townsend				1.90	
Troy	96	40°	67.6°	2.30	
Utica	95	38	64.7	2.00	
Virginia City	90[d]	37[d]	63.2[d]	2.19	
Warrick	94	33	61.0	1.40	
Wolf Creek	96	38	63.0	1.95	
Wolf Point				2.99	
Wolsey	90	28	57.2	3.28	
Nebraska					
Agate	93	36	65.0	2.58	
Ainsworth	97	42	71.7	6.29	
Albion	92[f]	37[f]	70.1[f]	2.83	
Alliance	99	41	70.7	3.75	
Alma	97	42	74.8	6.86	
Anoka				4.69	
Arapaho				3.75	
Arcadia				4.36	
Ashland	98	44	75.4	3.09	
Ashton				3.29	
Atkinson	98	42	71.2	4.08	
Auburn	99	43	74.8	4.05	
Aurora	102	42	75.9	4.39	
Beatrice	98	40	76.3	2.47	
Beaver	103	46	75.4	2.51	
Bellevue	95	48	75.2	2.27	
Blair	96	44	74.2	1.04	
Bloomfield	102	44	74.0	5.09	
Bluehill				1.72	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Nebraska—Cont'd.	°	°	°	*Ins.*	*Ins.*
Bradshaw				4.36	
Bridgeport	96	43	69.8	1.42	
Broken Bow	94	38	71.0	4.06	
Burchard				3.35	
Burwell				3.25	
Callaway	92	39	71.8	3.72	
Central City				2.14	
Chester				4.25	
Clearwater	103	40	73.9	3.54	
Cody				3.67	
Columbus	98	41	73.6	3.07	
Crawford				3.34	
Crete	98	45	75.8	2.98	
Culbertson	100	45	75.1	2.60	
David City	90	43	72.5	3.24	
Dawson	103	45	77.8	2.75	
Dubois				4.30	
Duff				5.25	
Dunning				3.50	
Edgar				2.47	
Ellis				1.95	
Ericson				2.28	
Ewing				4.10	
Fairbury	100	44	77.6	3.73	
Fairmont	97	42	73.1	2.43	
Fort Robinson	96	39	68.4	3.23	
Franklin	100°	38°	74.9°	1.92	
Fremont	97	47	73.8	4.66	
Fullerton				2.03	
Geneva	98	42	75.0	4.23	
Genoa (near)	95	45	73.9	3.45	
Gosper				4.65	
Gothenburg	96	38	72.4	4.05	
Grand Island	98	44	75.4	3.43	
Grant	98°	41°	70.0°	2.76	
Greely				2.25	
Guide Rock				0.95	
Haigler				2.50	
Halsey	97	43	71.9	5.84	
Hartington	99	42	72.8	10.75	
Harvard	93	39	72.2	3.44	
Hastings [e]	95	52	75.6	2.09	
Hayes Center	102	45	73.4	3.31	
Hay Springs	95	39	67.3	3.42	
Hebron	100	41	76.2	2.42	
Hendley				3.40	
Holbrook	97	47	73.2	5.79	
Holdrege	96	47	74.4	4.46	
Hooper	94	48	73.7	4.51	
Imperial	99	41	71.5	2.67	
Kearney	95	43	73.1	5.02	
Kennedy	97	41	70.0	4.82	
Kimball	91	43	68.2	2.06	
Kirkwood	100	42	72.0	5.46	
Leavitt	102	43	75.5	4.89	
Lexington	97	40	72.4	4.37	
Lodgepole	90	40	68.0	2.55	
Loup	94	38	71.8	3.00	
Lynch	104	40	73.8	2.92	
McCook				2.00	
McCool				2.54	
Madison	95	42	72.6	3.39	
Marquette	99	47		1.76	
Mason				4.30	
Merriman				2.50	
Minden	98	40	74.1	2.91	
Monroe				3.04	
Nebraska City	96	42	75.2	3.79	
Nemaha				4.83	
Norfolk	99	40	73.5	2.79	
North Loup	95	37	71.0	3.98	
Oakdale	98	40	73.0	3.53	
Oakland	95	41	73.4	3.95	
Odell				7.18	
Ord				6.75	
Palmer				2.50	
Palmyra [e]	98	56	75.4	2.65	
Pawnee City	98	42	75.8	4.74	
Plymouth	97	44	76.0	2.52	
Purdum	96	40	71.4	5.91	
Ravenna	96	38	73.0	4.57	
Republican				5.50	
Rulo				3.85	
St. Libory				3.40	
St. Paul	98	41	74.4	2.24	
Santee	104	45	74.3	4.60	
Schuyler				4.71	
Seward	98	40	75.4	4.35	
Smithfield				4.74	
Springview	96	42	70.6	6.38	
Stanton	99	42	74.2	2.83	
Strang				4.15	
Stratton				3.67	
Stromsburg				4.43	
Superior	102	41	76.0	2.07	
Syracuse				1.49	
Tablerock				2.44	
Tecumseh	101	41	75.6	4.34	

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Nebraska—Cont'd.	°	°	°	*Ins.*	*Ins.*
Tekamah	98	45	74.6	3.21	
Turlington	100	44	75.2	1.83	
University Farm	98	43	74.9	2.32	
Wahoo	.....	.....	.....	4.25	
Wakefield	99	39	72.5	6.18	
Watertown	.....	.....	.....	3.74	
Wauneta	.....	.....	.....	3.58	
Weeping Water	.....	.....	.....	2.99	
Westpoint	98	41	73.9	3.55	
Wilber	.....	.....	.....	3.87	
Winnebago	97	36	71.7	2.90	
Wisner	.....	.....	.....	3.02	
Wymore	.....	.....	.....	2.53	
York	97	43	74.6	1.45	
Nevada.					
Amos	100	39	70.3	0.26	
Austin	94	43	69.2	0.97	
Battle Mountain	102	48	75.0	T.	
Belmont	89	41	65.0	2.21	
Carlin [2]	95	53	72.3	0.00	
Carson City	93	39	67.8	0.10	
Carson Dam	98	45	74.8	0.10	
Clover Valley	93	35	65.2	0.03	
Columbia	99	47	72.9	1.53	
Dyer	96	37	67.6	1.30	
Elko [2]	100	50	73.1	0.06	
Ely	92	41	66.0	3.00	
Eureka	94	38	68.5	0.65	
Fallon	98	42	74.6	T.	
Gardnerville	91	38	67.0	0.20	
Geyser	95	36	62.9	4.93	
Golconda	99	40	71.6	0.05	
Halleck [2]	96	30	69.8	T.	
Hamilton	87	32	61.4	3.21	
Hazen	102	47	79.0	0.03	
Humboldt [2]	.....	50	70.4	0.00	
Leetville	100	50	76.7	0.00	
Lewers Ranch	92	40	67.6	0.07	
Logan	111	61	86.0	0.76	
Lovelocks	102	38	73.8	T.	
Mill City [2]	100	50	.....	0.00	
Mina	102	53	77.8	0.73	
Palisade	102	35	70.6	T.	
Palmetto	92	38	64.8	3.48	
Paradise Valley	.....	.....	.....	0.11	
Pioche	105	44	72.8	3.33	
Potts	98	31	64.6	0.10	
San Jacinto	97	36	64.4	0.95	
Soda Lake	101	43	74.9	.....	
Squaw Valley	104	34	66.8	0.18	
Tecoma	99	39	69.0	1.45	
Wabuska	93	39	68.3	T.	
Wells	98	26	65.3	0.23	
New Hampshire.					
Alstead	86	46	68.6	2.23	
Bartlett	.....	.....	.....	2.78	
Bethlehem	90	40	67.3	4.06	
Bretton Woods	.....	.....	.....	4.30	
Brookline	93	46	72.2	2.37	
Durham	96	42	70.2	2.87	
Franklin Falls	96	43	71.1	0.56	
Grafton	92	37	67.6	1.03	
Groveton	.....	.....	.....	3.69	
Hanover	96	42	70.1	2.48	
Keene	91	40	69.8	1.75	
Littleton	88	43	67.7	3.41	
Nashua	94	47	72.6	2.46	
Newton	91	43	69.0	1.45	
North Woodstock	.....	.....	.....	5.63	
Plymouth	96	40	70.4	1.59	
New Jersey.					
Asbury Park	94	63	74.8	7.92	
Bayonne	94	58	75.1	2.52	
Belvidere	93	52	74.2	2.36	
Bergen Point	92	58	74.8	2.21	
Beverly	94	62	76.0	8.92	
Bridgeton	96	63	77.3	7.38	
Browns Mills	93	56	75.0	8.96	
Canton	.....	.....	.....	10.27	
Cape May C. H	91	65	75.8	6.92	
Charlotteburg	89	42	71.4	4.04	
Clayton	91	62	75.7	11.58	
College Farm	93	55	74.4	3.95	
Dover	93	46	71.8	2.84	
Elizabeth	95	57	75.4	2.89	
Englewood	93	54	74.1	4.04	
Flemington	96	54	75.0	3.34	
Friesburg	96	62	76.4	7.59	
Hightstown	92	59	74.2	8.02	
Imlaystown	94	60	75.4	8.11	
Indian Mills	97	60	76.2	12.48	
Jersey City	96	59	75.9	2.54	
Lakewood	91	60	74.2	8.74	
Lambertville	94	59	75.8	4.44	
Layton	92	43	71.8	5.03	
Moorestown	92	62	75.2	9.43	
Newark	94	55	75.0	2.46	
New Brunswick	94	54	74.4	3.33	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
New Jersey—Cont'd.	°	°	°	*Ins.*	*Ins.*
Newton	93	45	73.2	5.51	
Oceanic	91	59	73.7	5.01	
Paterson	96	56	75.6	4.62	
Phillipsburg	94	54	75.2	4.09	
Plainfield	94	55	74.3	3.54	
Pleasantville	.....	.....	.....	9.60	
Rancocas	.....	.....	.....	10.23	
Rivervale	92	47	73.5	6.54	
Sandy Hook	94	64	75.0	4.57	
Somerville	96	55	75.6	4.12	
South Orange	91	53	73.4	3.90	
Sussex	90	48	72.6	4.16	
Toms River	94	59	75.2	17.91	
Trenton	92	62	75.4	6.44	
Tuckerton	96	64	76.4	11.36	
Vineland	94	62	75.6	12.51	
Woodbine	91	62	75.1	9.88	
New Mexico.					
Alamagordo	94	54	74.8	1.91	
Albert	98	51	74.4	0.95	
Albuquerque	92°	53°	74.3°	0.85	
Alto	.....	.....	.....	3.36	
Aragon	94	44	66.8	2.77	
Artesia	97	54	75.3	0.66	
Bellranch	98	52	76.0	0.34	
Bloomfield	98	43	72.3	0.73	
Carlsbad	100	59	78.9	1.32	
Chama	83	38	60.8	2.13	
Cimarron	87	45	65.5	2.26	
Cliff	99	49	72.8	3.00	
Cloudcroft	72	38	54.8	3.36	
Datil	93	40	64.8	1.63	
Deming	96	52	73.8	2.58	
Dorsey	88	47	68.0	2.49	
Dulce	88	35	64.0	1.77	
Eagle Rock Ranch	86	45	66.0	1.16	
Elk	87	50	66.7	6.64	
Estancia	91	40	68.0	1.73	
Fairview	88°	47°	66.4°	4.35	
Fort Bayard	90	49	68.6	4.84	
Fort Stanton	87	45	64.9	4.34	
Fort Union	84	41	63.2	2.40	
Fort Wingate	82	43	65.0	2.10	
Fruitland [2]	98	41	70.6	.....	
Glen	98	47	76.4	0.95	
Hillsboro	.....	.....	.....	6.58	
Hope	.....	.....	.....	3.55	
Laguna	93	46	69.5	1.26	
Lagunita	94	50	72.0	1.23	
Lake Valley	.....	.....	.....	5.95	
Las Vegas	94	44	66.8	1.97	
Logan	95	50	73.4	1.99	
Lordsburg	93	60	76.2	1.80	
Los Alamos	.....	.....	.....	1.42	
Los Lunas	94	54	75.2	3.15	
Luna	86	39	60.4	3.64	
Magdalena	85	47	66.9	2.75	
Manuelito	.....	.....	.....	2.03	
Mesilla Park	95	50	75.8	0.45	
Mimbres	.....	.....	.....	4.10	
Mineral Hill	.....	.....	.....	2.06	
Monument	98	53	75.2	1.89	
Nara Visa	94	52	73.3	0.94	
Orange	93	51	74.4	2.37	
Portales	95	50	73.1	3.67	
Red River	89	31	56.2	0.39	
Redrock	.....	.....	.....	2.08	
Rincon	94	54	75.2	4.20	
Rociada	77	35	56.5	1.70	
Rosa	.....	.....	.....	0.30	
Rosedale	80	49	64.0	3.56	
San Marcial	105	57	78.6	.....	
San Rafael	94°	43	69.2°	1.71	
Socorro	100	49	74.1	2.27	
Springer	92	46	68.4	1.18	
Strauss	.....	.....	.....	1.20	
Taos	88	43	66.6	1.25	
Tres Piedras	84	38	60.8	0.73	
Tucumcari	95	55	75.2	2.92	
Valley	.....	.....	.....	0.53	
Vermejo	77	38	58.0	2.84	
Weed	.....	.....	.....	4.11	
Whiteoaks	.....	.....	.....	2.82	
Winsor	80	34	56.0	2.84	
New York.					
Adams	90	48	71.0	3.37	
Addison	95	44	72.4	4.56	
Akron	.....	.....	.....	2.59	
Amsterdam	89	45	71.0	3.92	
Angelica	88	39	68.5	8.33	
Appleton	96	46	72.1	1.44	
Arcade	90	35	67.8	5.01	
Athens	88	51	72.2	3.69	
Atlanta	92	40	70.0	6.51	
Atwater	.....	.....	.....	4.70	
Auburn	92	47	72.0	3.73	
Avon	90	46	71.2	4.24	
Baldwinsville	91	49	71.8	3.24	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
New York—Cont'd.	°	°	°	*Ins.*	*Ins.*
Ballston Lake	90	42	70.1	4.76	
Bedford	92	52	73.1	3.54	
Berlin	88	43	69.2	3.60	
Blue Mountain Lake	.....	.....	.....	2.49	
Bolivar	91	39	69.7	6.18	
Bouckville	88	34	65.3	2.50	
Brockport	94	47	73.2	2.60	
Cape Vincent	86	47	70.7	1.71	
Carmel	90	53	71.6	3.60	
Carvers Falls	91	40	69.8	3.95	
Chatham	93	47	72.8	5.18	
Chazy	93	45	70.0	1.93	
Coeymans	95	47	71.5	2.60	
Cold Spring Harbor	97	54	73.8	2.37	
Cooperstown	86	45	68.0	6.48	
Cortland	97	40	69.0	4.18	
Cutchogue	90	55	73.0	1.56	
Dannemora	88	47	69.0	1.92	
Dekalb	91	42	70.1	5.65	
De Ruyter	89	40	68.2	3.39	
Easton	.....	.....	.....	5.24	
Elba	92	46	72.0	1.92	
Elmira	100	46	73.9	2.88	
Fayetteville	94	48	72.8	2.05	
Fort Plain	91	46	72.4	2.13	
Franklinville	91	38	68.8	4.71	
Gabriels	91	33	64.6	1.65	
Gansevoort	.....	.....	.....	2.99	
Glens Falls	91	46	71.4	3.33	
Gloversville	90	42	69.2	2.89	
Greenfield	90	46	70.2	2.77	
Greenwich	89°	42°	69.8°	1.84	
Griffin Corners	87	36	66.0	3.75	
Harkness	90	45	68.9	2.25	
Haskinville	.....	.....	.....	6.09	
Hemlock	88	51	71.4	4.44	
Hunt	90	42	69.8	4.79	
Indian Lake	90	30	65.9	3.63	
Ithaca	92	46	71.0	2.53	
Jamestown	91	46	72.4	3.29	
Jeffersonville	92	40	69.3	3.00	
Keene Valley	93	38	67.2	5.98	
Lake George	91	45	71.1	2.91	
Le Roy	90	47	71.8	3.21	
Littlefalls, City Res	89	47	69.4	2.80	
Lockport	91	51	72.5	1.98	
Lowville	90	41	68.4	1.69	
Lyndonville	.....	.....	.....	1.60	
Middletown	90	53	72.1	2.72	
Mohonk Lake	90	53	69.8	3.83	
Moira	93	47	70.2	2.95	
Mount Hope	95	51	73.2	3.15	
Newark Valley	.....	.....	.....	4.20	
New Lisbon	88	39	66.2	3.97	
North Lake	86	39	66.6	3.13	
Ogdensburg	90	52	71.3	2.77	
Oneonta	91	45	71.8	6.88	
Oriskany Falls	93	43	71.3	2.54	
Oswegatchie	92	38	67.6	.....	
Otto	91	50	70.9	2.44	
Oxford	88	45	69.6	5.53	
Palermo	.....	.....	.....	4.35	
Perry City	91	38	69.3	3.56	
Plattsburg	88	45	69.2	1.53	
Port Jervis	90	47	72.9	3.44	
Potsdam	92	41	70.7	2.54	
Richland	.....	.....	.....	1.38	
Ridgeway	91	50	72.6	3.70	
Romulus	91	50	72.0	2.22	
Salisbury Mills	91	40	69.4	3.37	
Saranac	89	36	65.7	2.45	
Scarsdale	90	52	71.6	1.45	
Scottsville	.....	.....	.....	3.79	
Setauket	90	60	72.7	4.73	
Shortsville	90	47	71.5	2.93	
Skaneateles	.....	.....	.....	5.44	
Southampton	86	55	72.1	2.85	
South Canisteo	91	40	69.1	5.69	
South Schroon	86	40	66.8	4.30	
Spier Falls	91	44	70.4	2.90	
Taberg	92	38	71.1	2.42	
Volusia	87	48	71.0	3.02	
Wappinger Falls	90	52	72.4	2.81	
Warwick	.....	.....	.....	3.76	
Watertown	89	43	71.0	1.92	
Waverly	96	42	72.4	3.20	
Wedgwood	90	48	70.5	4.81	
West Berne	90	41	69.6	6.62	
Westfield	89	50	72.6	2.58	
Windham	87	42	68.0	3.57	
Youngstown	.....	.....	.....	1.49	
North Carolina.					
Battleboro	.....	.....	.....	6.81	
Beaufort	91	70	81.4	11.09	
Brevard	91	58	74.4	9.07	
Brewers	93	62	77.4	11.60	
Bryson City	.....	.....	.....	4.38	
Buck Springs	80	52	65.8	11.79	

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
North Carolina—Cont'd.	°	°	°	*Ins.*	*Ins.*
Caroleen	95	57	78.6	12.64	
Chalybeate Springs	95	70	81.0	6.15	
Eagletown	93	69	79.8	10.98	
Fayetteville	92	70	78.0	7.14	
Goldsboro	92	69	79.2	6.07	
Graham	.....	.....	.....	9.71	
Greensboro	93	67	79.6	9.49	
Greenville	.....	.....	.....	9.88	
Henderson	90	67	77.8	16.00	
Horse Cove	84	60	71.7	12.09	
Hot Springs	92	62	79.8	.....	
Kinston	96	67	81.5	13.08	
Lenoir	94	60	77.3	7.83	
Lexington	93	62	78.8	13.47	
Lincolnton	95	65	78.8	.....	
Linville	80	53	67.0	.....	
Louisburg	92	69	79.2	7.46	
Lumberton	97	69	81.5	4.74	
Moncure	98	63	80.2	13.28	
Monroe	94	64	78.1	6.65	
Morganton	93	64	76.6	9.74	
Mountairy	93	63	76.9	11.68	
Mount Holly	.....	.....	.....	6.10	
Murphy	.....	.....	.....	6.88	
Nashville	96	69	80.3	5.70	
Newbern	96	69	81.0	10.67	
Patterson	86	62	73.2	7.94	
Pinehurst	95	68	80.2	14.33	
Pink Beds	84	50	67.2	13.63	
Randleman	.....	.....	.....	12.53	
Reidsville	94	65	78.6	8.18	
Rockingham	97	66	80.1	6.03	
Salem	93	66	78.6	12.92	
Salisbury	95	60	79.0	11.55	
Saxon	90	60	75.9	7.93	
Scotland Neck	92	68	79.6	7.62	
Selma	98	69	81.2	9.09	
Settle	93	60	76.2	12.24	
Sloan	95	66	79.5	10.11	
Snowhill	96	68	80.6	9.82	
Southern Pines	96	62	80.5	11.39	
Southport	92	71	81.8	4.60	
Statesville	91	61	77.3	6.37	
Tarboro	97	69	82.2	6.09	
Vade Mecum	91	54	75.9	10.70	
Washington	96	70	81.6	11.94	
Waynesville	85	58	71.8	4.84	
Weldon	97	69	81.3	13.42	
North Dakota.					
Amenia	101	38	66.4	2.57	
Beach	102	42	66.6	2.37	
Berlin	96	40	64.8	1.89	
Bottineau	101	36	66.3	1.81	
Buford	98	38	66.8	1.89	
Cando	98[d]	34[d]	65.2[d]	1.05	
Coalharbor	103	41	64.4	1.25	
Cooperstown	99	37	67.8	1.45	
Denbigh	105	40	68.1	1.72	
Dickinson	102	42	66.4	2.64	
Donnybrook	101	39	64.7	3.30	
Edgeley	96	42	66.4	1.56	
Edmore	102	33	64.6	0.75	
Ellendale	107	41	69.2	2.15	
Fargo	97	40	67.6	2.22	
Forman	98	42	67.9	2.45	
Fort Berthold	101	45	68.8	2.70	
Fort Yates	99	46	68.6	2.92	
Fullerton	94	41	65.4	2.20	
Glenullin	97	42	65.8	2.91	
Grafton	99	35	65.6	2.18	
Hannah	100	31	63.4	1.52	
Hillsboro	99	41	67.6	2.02	
Jamestown	97	40	66.7	1.69	
Kulm	96	41	68.6	2.38	
Lakota	98[d]	31[e]	65.2[d]	.....	
La Follette[e]	106	40	69.6	.....	
Langdon	94	37	63.6	1.66	
Larimore	103	40	65.0	2.46	
Lisbon	96	38	65.2	2.80	
McKinney	103	37	64.7	2.43	
Manfred	100	42	65.8	1.33	
Medora	107[d]	41[d]	68.2[d]	2.33	
Melville	101[e]	43[d]	67.9[d]	0.73	
Minot	101	43	66.0	1.59	
Minto	98	36	65.9	2.07	
Moyersville	99	40	65.1	0.52	
Napoleon	102	36	65.8	1.51	
New England	103	41	74.5	3.00	
Oakdale	101	42	66.6	2.17	
Oriska	96	43	65.7	2.40	
Palermo	100	52	72.9	.....	
Park River	99	37	66.4	0.80	
Pembina	97	32	64.4	2.51	
Portal	99	33	64.5	1.76	
Power	98	39	66.4	1.52	
Pratt	102	39	64.8	1.25	
Steele	102	40	68.3	1.54	
University	96	35	65.8	1.09	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
North Dakota—Cont'd.	°	°	°	*Ins.*	*Ins.*
Walhalla	95	34	66.2	0.34	
Willow City	99	36[h]	65.4[d]	.....	
Wishek	97	40	65.0	2.12	
Ohio.					
Akron	91	50	74.0	5.37	
Amesville	96	50	77.0	4.12	
Atwater	90	48	72.4	3.54	
Bangorville	93	50[g]	73.9[d]	1.96	
Bellefontaine	91	48	74.1	2.27	
Benton Ridge	92[e]	50[e]	74.0[e]	5.30	
Bladensburg	90	45	72.6	8.03	
Bowling Green	93	48	73.6	5.61	
Bucyrus	91	48	73.5	3.74	
Cadiz	92	50	74.6	4.62	
Cambridge	91	46	73.9	5.42	
Camp Dennison	95	52	76.9	6.37	
Canal Dover	92	46	73.7	3.64	
Canton	89	49	72.9	4.28	
Cardington	92	44	73.9	2.96	
Circleville	93	52	74.5	3.37	
Clarington	94	53	76.6	5.59	
Clarksville	92	52	76.4	5.03	
Cleveland[b]	91	53	74.0	4.38	
Coalton	94	49	75.6	3.59	
Dayton	94	50	76.6	5.56	
Defiance	98	46	75.6	2.22	
Delaware	92	47	74.0	3.70	
Demos	90	50	74.3	7.37	
Findlay	101	51	76.8	4.82	
Fremont	94	52	75.2	9.51	
Garrettsville	91	44	71.7	7.17	
Granville	91	48	74.9	5.22	
Gratiot	89	48	73.3	6.58	
Green	92	56	76.8	7.23	
Greenhill	90	43	71.8	5.68	
Greenville	95	50	75.0	7.19	
Hedges	99	46	74.5	5.74	
Hillhouse	92	45	74.2	4.29	
Hiram	88	51	72.6	7.46	
Hudson	93	46	73.7	4.76	
Ironton	96	56	79.2	4.78	
Jacksonburg	94	53	76.8	4.94	
Killbuck	91	48	73.6	5.61	
Lancaster	88	49	74.6	2.82	
Lima	93	50	74.0	6.04	
McConnelsville	92	49	75.2	4.68	
Manara	90	50	73.7	3.54	
Marietta	90	55	77.0	4.18	
Marion	94	46	75.0	2.24	
Medina	94	46	73.6	4.09	
Milfordton	92	45	73.2	7.01	
Milligan	93	48	74.6	3.81	
Millport	89	44	71.9	4.03	
Napoleon	93	50	74.3	5.97	
Nellie	88	51	73.3	6.15	
New Alexandria	93	48	74.9	6.30	
New Berlin	95	45	72.5	4.30	
New Bremen	95	49	73.6	2.21	
New Richmond	94	54	77.0	3.86	
New Waterford	91	45	72.2	5.44	
North Lewisburg	95	46	75.2	5.00	
North Royalton	92	48	73.7	4.97	
Norwalk	94	49	74.4	8.12	
Oberlin	94	48	73.3	5.16	
Ohio State University	90	50	74.3	7.15	
Orangeville	92	44	72.0	3.25	
Ottawa	95	50	75.9	4.11	
Pataskala	91	49	73.9	9.32	
Philo	94	49	75.9	2.12	
Plattsburg	93	49	74.2	4.09	
Pomeroy	95	53	76.6	4.15	
Portsmouth	92	54	76.8	3.35	
Pulse	88	53	74.4	2.34	
Rittman	94	45	72.6	4.98	
Rockyridge	95	52	74.8	4.08	
Shenandoah	91	48	73.0	4.06	
Sidney	95	50	76.2	3.31	
Somerset	93	53	76.4	4.71	
South Lorain	92	47	73.4	4.63	
Springfield	.....	.....	.....	4.07	
Summerfield	92	45	74.0	5.08	
Thurman	95	55	77.2	3.61	
Tiffin	91	52	74.6	2.81	
Toledo (St. Johns College)	93	56	74.7	2.84	
Upper Sandusky	92	49	74.4	2.13	
Urbana	92	47	74.4	5.48	
Vickery	93	52	74.0	5.96	
Warren	93	45	73.8	6.01	
Wauseon	94	47	73.7	4.64	
Waverly	95	51	77.6	4.19	
Waynesville	90[e]	52[e]	74.6[e]	5.86	
Wellington	93	49	74.4	3.50	
Willoughby	.....	.....	.....	2.63	
Wilson	93	52	76.0	6.30	
Wooster	91	48	74.2	7.38	
Zanesville	.....	.....	.....	3.47	
Oklahoma.					
Alva	96	52	77.4	3.00	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Oklahoma—Cont'd.	°	°	°	*Ins.*	*Ins.*
Arapaho	96	52	76.0	5.82	
Beaver	98[g]	41[g]	77.6[g]	4.07	
Chandler	99	53	80.0	10.47	
Chattanooga	95	54	78.6	7.58	
Cloud Chief	92	50	75.2	4.63	
Dacoma	97	49	77.0	3.83	
Enid	95	49	77.3	10.47	
Erick	96	56	80.0	3.59	
Fort Reno	96	45	75.8	2.80	
Fort Sill	94	54	78.2	5.75	
Gage	98	50	77.1	4.29	
Grande	94	49	77.0	7.00	
Guthrie	94	52	78.2	6.67	
Harrington	95	50	74.8	4.00	
Hennessey	96	51	77.8	5.80	
Hobart	96	55	78.4	5.22	
Hooker	100	50	77.2	3.00	
Kenton	97	51	74.7	1.16	
Kingfisher	96	51	78.1	4.42	
McComb	93	50	77.3	8.35	
Mangum	100	55	80.0	5.28	
Meeker	95	56	77.8	9.60	
Neola	95	55	77.6	5.86	
Newkirk	97	48	78.8	4.06	
Okeene	99	49	77.4	7.51	
Pawhuska	94	50	78.0	6.41	
Perry	96	48	77.5	7.83	
Sac and Fox Agency	92	53	77.9	6.74	
Shawnee	95	53	77.6	7.12	
Stillwater	93	52	77.1	7.71	
Temple	101	51[e]	80.0	3.48	
Waukomis	95	51	78.0	8.10	
Weatherford	98	50	77.4	2.52	
Whiteagle	95	48	77.6	5.83	
Oregon.					
Alta	.....	.....	.....	0.82	
Albany	93	43	69.0	0.00	
Alpha	97	37	66.0	T.	
Ashland	95	48	71.2	0.00	
Astoria	78	50	62.3	0.28	
Aurora (near)	91	43	66.2	0.00	
Bay City	74	40	57.8	0.29	
Bend	95	29	62.8	T.	
Beulah	108	29	65.8	1.00	
Blackbutte	89	40	64.2	0.05	
Blalock	106	54	79.2	T.	
Bullrun	95	44	66.6	0.79	
Burns	96	37	67.7	0.43	
Carlton	94	39	65.7	0.60	
Cascade Locks	93	47	70.0	0.09	
Coquille	.....	.....	.....	T.	
Corvallis	98	43	67.2	0.00	
Dale	.....	.....	.....	0.59	
Dayville	103	39	70.2	0.71	
Doraville	87	45	64.0	0.01	
Drain	99	35	66.6	0.02	
Echo	102	47	73.8	0.15	
Ella	103	45	75.0	0.72	
Eugene	90	45	66.3	T.	
Fairview	89	39	62.0	T.	
Falls City	91	41	64.6	T.	
Forestgrove	95	41	66.2	0.00	
Gardiner	78	45	60.0	0.18	
Glendale	100	34	66.3	0.00	
Glenora	94	36	63.9	0.28	
Gold Beach	79	37	57.2	0.09	
Government Camp	83	36	57.4	0.40	
Granite	94	28	60.6	0.71	
Grants Pass	103	36	70.2	0.00	
Grass Valley	95	38	67.8	0.34	
Heisler	98	29	66.6	T.	
Heppner	99	43	69.2	0.43	
Hood River	95	44	70.4	0.01	
Huntington	104	46	77.7	0.33	
Jacksonville	100	44	72.4	0.00	
Joseph	91	36	63.0	1.03	
Kerby	99	36	67.6	0.00	
Klamath Falls	98	34	68.6	0.00	
Lagrande	101	40	69.8	0.51	
Lakeview	99	35	68.4	0.00	
Lonerock	96	38	65.2	0.41	
Lost River	93	37	66.2	0.00	
McKenzie Bridge	100[e]	33[e]	66.4[e]	0.20	
McMinnville	95[g]	53[g]	66.5[g]	T.	
Marshfield	73	46	59.5	0.11	
Mill City	94	34	63.5	T.	
Monroe	92	40	66.4	0.00	
Mountain Park	92	42	67.3	0.02	
Mount Angel	97	50	70.6	T.	
Nehalem	.....	.....	.....	0.79	
Newport	70	42	56.4	0.17	
Odell	.....	.....	.....	T.	
Olex	100	47	71.3	0.11	
Paisley	89	40	66.5	0.94	
Pendleton	102	43	71.0	0.44	
Port Oxford	71	46	58.2	0.08	
Prineville	93	34	64.1	0.10	
Prospect	95	30	67.8	0.00	

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Oregon—Cont'd.	°	°	°	*Ins.*	*Ins.*
Richland	102	40	69.4	0.53	
Riverside	107[a]	35[a]	70.8[a]	T.	
Salem	92	46	68.4	T.	
Silverlake	93	28	62.4	0.78	
Stafford	97	43	68.4	0.15	
The Dalles	96	50	72.2	0.31	
Toledo	81	39	61.0	0.13	
Umatilla	106	50	77.8	0.17	
Van				0.20	
Wallowa	100	32	64.0	0.81	
Wamic	97	33	67.0	T.	
Warm Spring	104	40	70.2	0.00	
Weston	97	39	66.8	0.61	
Williams	99	35	69.0	T.	
Pennsylvania.					
Aleppo	92	48	73.6	6.28	
Altoona	90[1]	50[1]	70.8[1]	8.36	
Baldwin	89	43	71.9	6.51	
Bellefonte	94	51	75.0	4.64	
Browers				8.54	
California	94	52	76.0	8.10	
Cassandra	85	47	69.0	9.23	
Centerhall	91	50	69.3	3.64	
Clarion				8.22	
Claysville	94	45	74.2	4.53	
Coatsville	95	60	75.8	8.49	
Confluence				8.14	
Davis Island Dam				1.72	
Derry	93	46	74.7	4.03	
Doylestown				5.62	
Dushore	89	40	69.0	3.60	
East Mauch Chunk	95	48	74.2	5.02	
Easton	92	56	74.4	3.93	
Ellwood Junction				6.64	
Emporium	88	49	70.7	3.76	
Ephrata	95	57	75.0	4.50	
Everett	89	43	72.4	8.27	
Forks of Neshaminy				6.65	
Franklin	92	45	71.8	6.18	
Freeport	96	50	74.4	5.00	
Gettysburg	94	57	74.6	8.54	
Girardville				2.75	
Gordon	93	48	72.2	3.39	
Greensboro				3.02	
Greenville	92	44	73.0	5.79	
Hamburg	95	53	76.0	8.46	
Hanover	94	50	76.0	6.85	
Herrs Island Dam				3.33	
Huntingdon	93	50	75.2	5.77	
Hyndman				9.62	
Indiana	92	47	73.7	6.26	
Irwin	93	48	75.0	7.25	
Johnstown	95	53	75.4	8.19	
Keating				4.41	
Kennett	89	61	74.0	7.66	
Lansdale				3.91	
Lawrenceville	94	42	71.4	3.18	
Lebanon	93	58	75.4	6.76	
Leroy	90	47	70.3	4.51	
Lewisburg	92	53	73.8	5.97	
Lockhaven	95	52	74.4	4.14	
Lock No. 4				5.90	
Lycippus	89	52	73.6	8.99	
Marion	93	57	73.6	5.95	
Mifflintown	92	53	73.4	6.60	
Milford	94	43	71.6	6.06	
Montrose	91	45	71.0	4.44	
New Germantown	91	56	73.1	6.57	
Ottsville				3.29	
Parker				6.90	
Philadelphia	94	64	76.4	10.80	
Pocono Lake	87	39	68.0	4.24	
Point Pleasant				2.93	
Pottsville				3.67	
Reading	93	58	76.1	3.41	
Renovo				2.70	
Saegerstown	91	41	70.8	3.17	
St. Marys	90	45	69.5	5.62	
Saltsburg				7.76	
Seisholtzville				5.35	
Selinsgrove	92	53	74.4	3.44	
Shawmont				7.48	
Skidmore	91	43	73.0	3.91	
Smiths Corners				3.28	
Somerset	89	48	69.6	11.17	
South Eaton	90	48	71.4	4.15	
Springdale				7.41	
Springmount				3.09	
State College	88	51	70.9	4.19	
Towanda	91	45	71.6	3.55	
Uniontown	91	54	75.4	8.28	
Warren	92	46	72.0	2.67	
Wellsboro	90	42	69.8	4.07	
Westchester	95	62	75.8	7.47	
West Newton				8.60	
Whitehaven	90	47	70.6	3.35	
Wilkesbarre	91	50	73.9	1.62	
Williamsport	90	53	73.8	5.32	
Rhode Island.	°	°	°	*Ins.*	*Ins.*
Bristol	83	55	70.2	2.19	
Kingston	89	50	70.4	1.02	
Pawtucket				3.32	
Providence	94	55	75.4	3.14	
South Carolina.					
Aiken	96	70	83.5	6.12	
Anderson	94	67	80.2	4.52	
Barksdale[a]	95	68	80.4		
Batesburg	96	65	80.2	8.56	
Beaufort	96	71	81.2	7.24	
Bennettsville	96[f]	71[f]	80.7[f]	3.51	
Blackville	100	69	83.4	10.83	
Blair				7.35	
Bowman	100	67	81.2	10.06	
Calhoun Falls				8.08	
Camden	96[a]	69[a]	80.6[a]	4.92	
Chappells				6.10	
Cheraw	92	70	79.9	10.36	
Clarks Hill	99	65	79.7	8.00	
Clemson College	93	66	79.0	7.35	
Conway	99	69	81.3	9.00	
Dillon	98	69		2.43	
Due West	94	67	79.4	7.23	
Edisto				11.67	
Effingham				7.40	
Enoree				5.85	
Florence	98	69	81.8	5.76	
Georgetown	92	72	80.4	6.72	
Greenville	90	62	75.4	4.23	
Greenwood	94	66	79.3	6.32	
Heath Springs	98	68	82.1	5.33	
Kingstree	95	73	82.0	4.35	
Liberty	94	65	79.2	7.56	
Little Mountain	97	65	80.2	7.50	
Newberry	98	67	81.4	7.27	
Pelzer				8.12	
St. Georges	96	71	82.4	5.84	
St. Matthews	92	69	79.4	6.26	
St. Stephens				4.23	
Saluda	97	67	81.2	7.98	
Santuck	95	65	79.7	8.37	
Selvern	97[a]	66[a]	81.0[a]	11.69	
Smiths Mills				7.35	
Society Hill	93	70	80.6	5.19	
Spartanburg	95	65	79.8	12.45	
Stateburg	95	70	80.4	10.90	
Summerville	98	68	81.1	6.26	
Sumter	99	68	82.4	3.95	
Trenton	96	60	80.4	6.89	
Trial	97	68	80.6	5.21	
Walhalla	100	64	78.8	7.67	
Walterboro	96	67	79.8	4.62	
Winthrop College	94	68	80.0	6.95	
Yemassee	94	70	80.0	4.25	
Yorkville	96	69	80.6	11.66	
South Dakota.					
Aberdeen	100	39	67.9	4.76	
Academy	101	41	71.7	4.41	
Alexandria	101	40	72.0	5.18	
Armour	101	41	73.0	6.34	
Ashcroft	106	42	68.0	4.13	
Bowdle	96	41	67.6	6.87	
Brookings	100	39	69.4	4.28	
Canton	97	40	71.2	6.84	
Castlewood	98	39	68.2	3.93	
Centerville	97	42	71.8	10.15	
Chamberlain	102	40	72.4	3.26	
Cherry Creek	104	39	71.9	6.53	
Clark	99	41	66.4	5.40	
Clear Lake	95	44	69.2	4.58	
Desmet	98	42	69.4	4.54	
Doland	96	38	70.0	5.05	
Elkpoint	100	47	74.4	2.30	
Fairfax	99	41[d]	73.0	4.78	
Farmingdale				2.75	
Faulkton	95	43	67.3	4.57	
Flandreau	96	41	69.4	7.41	
Forestburg	98	38	69.0	6.53	
Fort Meade	101	43	68.5	5.55	
Greenwood	104	45	74.4	6.60	
Hermosa	98	39	67.4	4.35	
Highmore	98	42	69.2	6.74	
Howard	99[d]	42[d]	70.4[d]	6.63	
Howell	98	39	68.5	5.37	
Ipswich	99	40	67.9	5.29	
Kennebec	100	37	70.2	6.68	
Kidder	95	44	66.0	2.05	
Kimball	95	44	71.3	6.68	
Leola	98	40	66.4	2.70	
Little Eagle	102	36	68.8	1.75	
Marion	97	44	72.6	8.37	
Mellette	100	38	67.4	5.40	
Menno	97	44	72.0	5.65	
Mil'bank	101	45	69.1	5.22	
Mitchell	102	43	72.5	4.96	
Oelrichs	102	40	68.6	3.45	
Orman	106	41	68.6	1.87	
Plankinton	96	42	71.7	10.20	
South Dakota—Cont'd.	°	°	°	*Ins.*	*Ins.*
Ramsey	97	37	70.2	5.17	
Redfield	98	40	68.2	7.01	
Rosebud Agency	99	43	70.8	3.47	
Roslyn	94	44	66.3	7.33	
Sioux Falls	100	44	72.8	8.08	
Spearfish	101			1.63	
Stephan	97	38	68.8	6.49	
Tyndall	103	46	73.6	9.75	
Watertown	93	38	66.6	4.25	
Wentworth	101	43	70.8	5.01	
Woolsey				8.61	
Tennessee.					
Andersonville	92	60	77.9	5.65	
Arlington	95	55	78.3	2.64	
Ashwood	94	55	76.6	6.71	
Benton	94	63	78.3	5.33	
Bluff City				4.29	
Bolivar	95	50	78.0	1.87	
Brownsville	92	56	78.4	3.16	
Byrdstown	93	53	77.4	1.96	
Carthage	94	63	78.8	4.34	
Cedar Hill	101	55	80.7	4.83	
Celina				3.85	
Charleston				6.11	
Clarksville	94	56	78.2	3.07	
Clinton				6.01	
Covington	93	56	78.9	5.32	
Decatur	95	61	79.2	3.85	
Dover	97	54	79.4	3.81	
Dyersburg	93	58	78.3	5.79	
Elizabethton	92	63	77.2	8.12	
Erasmus	91	55	73.4	4.32	
Florence	90	61	77.2	4.19	
Franklin	91	60	76.8	1.93	
Greeneville	89	62	75.8	6.27	
Halls Hill				4.20	
Harriman	92	63	77.6	3.23	
Hohenwald	94	52	74.8	5.22	
Iron City	96	55	77.6	2.05	
Johnsonville	96	53	78.4	4.99	
Jonesboro	90	60	75.8	7.55	
Kenton	95	54	78.5	4.25	
Kingston				3.52	
Lafayette	98	57	77.8	4.23	
Leadvale				3.44	
Lewisburg	96	59	78.6	4.24	
Loudon				5.70	
Lynnville	91	60	77.0	4.72	
McGee				3.58	
McMinnville	93	61	76.8	5.37	
Maryville	94	61	78.0	4.73	
Milan	93	53	78.0	3.54	
Monterey	92	62	75.4	2.76	
Newport	91	64	77.1	4.82	
Palmetto	95	60	77.9	5.93	
Pope		51		2.80	
Rogersville	94	63	77.6	4.01	
Rugby	94	56	74.9	4.59	
Savannah	94	56	77.6	2.26	
Sevierville	97	63	78.6	7.23	
Sewanee	89	61	74.4	6.81	
Silver Lake	83	58	71.6	6.92	
Sparta	92	61	77.3	3.15	
Springdale	97	62	78.8	4.00	
Springville	94	51	77.8	3.57	
Tazewell				6.71	
Tellico Plains	93	62	78.0	4.72	
Tracy City	88	57	73.8	4.08	
Trenton	95	51	78.0	4.08	
Tullahoma	93	60	77.1	7.53	
Union City	93	54	77.4	5.45	
Walling				5.20	
Watertown	99	59	79.4	2.25	
Waynesboro	93	54	77.0	2.78	
Wildersville	89	56	76.6	4.37	
Yukon	93	62	78.1	3.54	
Texas.					
Albany	98	53	78.6	7.51	
Alvin				4.54	
Arthur				1.22	
Athens	99	60	82.9	0.50	
Austin	96	67	83.6	2.53	
Ballinger	98	58	79.5	12.54	
Barstow	95	61	78.1	2.02	
Beaumont				2.55	
Beeville	98	65	82.8	3.41	
Big Spring	97	62	78.4	5.08	
Blanco	100	60	80.6	1.83	
Boerne	98	54	79.1	1.95	
Bonham	94	52	80.3	4.00	
Booth				2.13	
Bowie	101	53	80.9	2.84	
Brazoria	91	65	80.5	5.15	
Brenham	93	63	80.9	2.83	
Brighton				1.35	
Channing	96	54	75.5	2.47	
Childress	96	53	77.2	2.32	
Clarksville	98	54	80.6	5.79	

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Texas—Cont'd.	°	°	°	*Ins.*	*Ins.*
Claude	92	56	74.0	2.60	
Claytonville	95	50	74.4	6.29	
Coleman	90	59	76.6	10.72	
College	99	61	82.5	4.72	
Colorado	95	59	78.2	7.82	
Columbus	.....	.....	.....	3.56	
Corsicana	99	55	82.2	3.82	
Crockett	100	55	82.4	1.28	
Cuero	98	62	83.8	2.43	
Dallas	97	55	80.0	4.25	
Danevang	97	64	82.5	4.54	
Denison	.....	.....	.....	4.00	
Dialville	94	58	80.3	3.11	
Duval	95	62	81.0	2.27	
Eagle Pass	100	67	84.8	3.03	
Fort Brown	94	72	83.8	7.92	
Fort Clark	93	63	79.6	4.00	
Fort Davis	88	52	70.7	5.69	
Fort McIntosh	103	68	84.4	3.30	
Fort Stockton	96	59	75.8	5.85	
Gainesville	94[e]	50[e]	78.2[e]	4.96	
Gatesville	95	64	80.6	2.76	
Georgetown	98	57	81.4	3.56	
Gonzales	.....	.....	.....	3.76	
Graham	.....	.....	.....	2.90	
Grapevine	98	54	81.4	3.41	
Greenville	99	56	81.4	3.53	
Hale Center	95	51	73.6	2.12	
Hallettsville	99	66	84.6	0.85	
Hempstead	.....	.....	.....	2.89	
Henrietta	98	52	79.3	5.72	
Hewitt	.....	.....	.....	1.00	
Hillsboro	99	53	81.4	2.00	
Hondo	95	65	82.9	4.02	
Houston	101	66	84.3	1.75	
Hubbard	96	57	81.0	1.69	
Huntsville	98	59	81.4	1.79	
Jefferson	92	54	79.3	2.65	
Jewett	97	53	80.4	1.25	
Junction	.....	.....	.....	4.44	
Kaufman	98	56	83.0	4.21	
Kent	92	57	71.0	5.16	
Kerrville	98	53	82.4	3.47	
Knickerbocker	96	55	78.4	11.31	
Kopperl	.....	.....	.....	3.24	
Lampasas	99	54	81.4	2.36	
Lapara	.....	.....	.....	3.13	
Liberty	100	62	83.2	2.10	
Longlake	.....	.....	.....	2.25	
Longview	98	57	81.4	5.17	
Luling	98	61	83.3	1.40	
Marlin	100	55	82.6	1.02	
Mexia	98	57	81.4	1.74	
Miami	93	50	75.6	4.59	
Mount Blanco	93	59	75.4	4.21	
Mount Pleasant	98	52	80.4	2.10	
Nacogdoches	92	56	79.1	1.68	
Nazareth	93	54	73.0	3.33	
New Braunfels	95	63	81.6	3.66	
Paris	98	56	81.5	4.18	
Port Lavaca	95	70	83.2	3.70	
Quanah	96	55	79.2	3.43	
Rhineland	99	40	77.7	4.65	
Riverside	.....	.....	.....	1.81	
Rockisland	99	66	83.0	1.66	
Rockland	.....	.....	.....	1.10	
Rockport	90	68	79.4	3.75	
Sabinal	100	56	82.6	4.26	
San Marcos	97	63	81.4	4.48	
San Saba	100	52	83.4	1.29	
Santa Gertrude	.....	.....	.....	3.92	
Seymour	98	52	78.4	4.47	
Sonora	93[d]	57[d]	77.0[d]	4.26	
Sulphur Springs	95	55	80.4	3.65	
Temple	97	58	80.8	2.73	
Texline	95	51	73.4	1.00	
Tilden	104	62	84.6	2.12	
Valley Junction	.....	.....	.....	4.01	
Victoria	95	64	81.6	4.52	
Waco	97	60	83.2	4.34	
Waxahachie	99	53	80.9	5.29	
Weatherford	98	54	81.0	2.56	
Wharton	98	63	82.3	3.58	
Willspoint	98	55	80.6	3.55	
Utah.					
Alpine	.....	.....	.....	3.77	
Aneth	99	51	76.2	0.54	
Beaver	88	40	66.2	2.04	
Blackrock	.....	.....	.....	1.12	
Blacksmith Fork	.....	.....	.....	3.15	
Castledale	92	35	64.9	0.89	
Castle Rock	.....	.....	.....	2.57	
Corinne	100	51	70.8	3.85	
Cayoto	90[e]	29[e]	61.8[e]	1.48	
Deseret	96	38	70.4	0.63	
Emery	95	41	69.2	1.28	
Enterprise	.....	.....	.....	4.04	
Escatante[i]	89	43	68.2	.....	
Farmington	94	45	69.6	3.20	
Fillmore	105	46	73.2	1.20	
Fort Duchesne	95	44	69.2	1.50	
Giles	99	41	74.4	0.43	
Government Creek	94	43	71.2	1.34	
Grayson	92	46	70.0	1.23	
Heber	92	36	64.8	3.11	
Henefer	93	35	64.3	2.07	
Hite	104	59	81.4	1.28	
Huntsville	.....	.....	.....	3.54	
Ibapah	92	36	66.4	2.80	
Indianola	.....	.....	.....	0.30	
Kanab	90[e]	40[c]	64.9[e]	2.00	
La Sal	85	42	65.6	1.38	
Levan	90	43	67.8	1.31	
Loa	90	32	62.8	0.56	
Logan	95	55	72.2	4.55	
Manti	91[e]	42	67.7[e]	1.69	
Marion	.....	.....	.....	3.87	
Marysvale	89	37	64.6	0.91	
Meadowville	89	38	64.2	2.80	
Millville	.....	.....	.....	3.64	
Moab	98	46	75.4	0.58	
Morgan	90	37	65.5	4.57	
Mount Nebo	95	49	74.2	0.86	
Mount Pleasant	94	43	69.0	1.87	
Nephi	.....	.....	.....	1.57	
Oak City	99	44	71.8	1.56	
Ogden	93	50	71.2	4.11	
Parowan	94	40	67.2	3.10	
Payson	.....	.....	.....	2.10	
Pinto	92	37	64.0	2.82	
Plateau	89	31	62.3	1.24	
Provo	103	44	74.4	1.80	
Ranch	86	35	61.2	3.85	
Randolph	.....	.....	.....	2.19	
Richfield	92	36	66.4	1.04	
Rockville	104	50	79.0	4.11	
St. George	104	50	79.8	1.04	
Salt Air	91	51	71.6	3.12	
San Juan	.....	.....	.....	1.06	
Scipio	93	37	66.5	1.64	
Snowville	97	35	65.3	0.73	
Soldier Summit	100	33	63.5	1.20	
Sunnyside	.....	.....	.....	1.15	
Theodore	92	45	68.4	1.28	
Thistle	105	42	73.4	2.77	
Tooele	93	49	71.4	2.85	
Tropic	89	40	63.2	3.64	
Trout Creek	96	39	68.8	1.00	
Utah Lake	93	41	66.8	2.14	
Vernal	91	49	69.6	1.02	
Wellington	95	39	69.0	0.67	
Vermont.					
Bloomfield	93	37	66.8	3.44	
Cavendish	97	39	69.8	2.95	
Chelsea	88	44	65.8	4.68	
Enosburg Falls	92	38	68.6	1.49	
Jacksonville	89	40	67.7	1.76	
Manchester	85	39	67.2	1.95	
Norwich	91	41	.....	2.98	
St. Johnsbury	96	39	69.3	4.71	
Wells	86	44	68.4	2.67	
Westfield	.....	.....	.....	2.46	
Woodstock	90	33	66.0	2.98	
Virginia.					
Arvonia	98	63	78.1	9.02	
Ashland	93	63	77.2	12.18	
Barboursville	90[e]	64[e]	75.7[e]	10.82	
Bigstone Gap	87	60	74.7	8.58	
Blacksburg	87	56	73.3	8.63	
Bristol	90	64	76.6	4.86	
Buchanan	.....	.....	.....	5.66	
Callaville	93	57	77.1	16.75	
Charlottesville	93	59	75.1	14.41	
Clarksville	.....	.....	.....	10.49	
Columbia	93	64	77.0	9.83	
Dale Enterprise	92	56	74.0	6.64	
Danville	.....	.....	.....	7.22	
Dinwiddie	94	65	78.0	11.60	
Doswell	94[d]	63[d]	78.8[d]	6.49	
Elk Knob	87	62	74.2	5.82	
Farmville	.....	.....	.....	10.59	
Fredericksburg	93	63	76.8	12.96	
Grahams Forge	85	60	73.0	6.39	
Hampton	91	70	79.6	11.02	
Hot Springs	83	50	76.2	6.34	
Ivanhoe	.....	.....	.....	10.93	
Lexington	94	63	76.4	10.58	
Lincoln	96	60	76.4	11.85	
Marion	88	59	73.4	6.95	
Mendota	.....	.....	.....	5.03	
Milford	94	55	74.3	12.48	
Newport News	94	69	79.8	12.54	
Nokesville (near)	89	61	74.6	11.12	
Petersburg	93	60	80.7	8.98	
Quantico	93	62	77.6	11.41	
Radford	.....	.....	.....	6.40	
Randolph	.....	.....	.....	7.43	
Riverton	.....	.....	.....	8.78	
Roanoke	98[e]	57[g]	77.4[f]	7.88	
Rockymount	98	62	77.2	7.73	
Shenandoah	.....	.....	.....	5.74	
Skyland	.....	.....	.....	11.39	
Speers Ferry	.....	.....	.....	7.81	
Spottsville	94	68	78.2	14.81	
Staunton	91	61	75.1	7.47	
Stephens City	94	60	75.0	9.85	
Warsaw	94[f]	63[f]	78.2[f]	6.27	
Williamsburg	93	67	78.6	16.55	
Woodstock	96	60	75.8	5.53	
Washington.					
Aberdeen	90	42	61.1	0.58	
Ashford	.....	.....	.....	0.51	
Baker	86	41	64.9	0.34	
Bellingham	79	41	61.1	0.53	
Blaine	80	44	61.6	0.25	
Brinnon	84	46	64.0	0.35	
Cedar River	.....	.....	.....	0.10	
Cedonia	99	37	67.5	0.13	
Centralia	92	36	63.8	0.02	
Cheney	100	37	67.1	0.03	
Clearbrook	86	34	61.3	0.53	
Clearwater	86	44	63.6	0.40	
Cle Elum	95	35	64.0	0.03	
Colfax	96	35	65.2	1.10	
Colville	99	33	65.0	0.76	
Conconully	93	38	65.8	0.65	
Coupeville	81	45	62.1	0.18	
Crescent	101	38	67.1	0.36	
Cusick	100	33	63.4	0.84	
Danville	98	42	67.2	0.25	
Dayton	95	43	69.2	0.67	
East Sound	83	35	60.2	0.18	
Ellensburg	95	40	67.5	0.33	
Ephrata	101	49	75.2	0.00	
Fort Simcoe	101	49	72.6	T.	
Goldendale	95	38	66.0	0.02	
Granite Falls	.....	.....	.....	0.35	
Hatton	105	39	70.6	0.32	
Ilwaco	85	49	60.4	0.44	
Kennewick	102	48	76.0	T.	
Kiona	101	45	72.5	0.28	
Kosmos	96	27	65.0	0.21	
Lacenter	91	40	65.8	0.01	
Lakeside	100	52	74.1	0.10	
Lester	95	33	62.2	0.50	
Lind	100	45	70.2	0.42	
Loomis	99	49	71.4	0.28	
Merritt	.....	.....	.....	0.23	
Mottinger Ranch	108	52	77.2	0.09	
Mount Pleasant	90	44	67.0	0.25	
Moxee	104	41	69.6	T.	
Northport	98	30	63.0	0.60	
Odessa	95[j]	40[j]	67.8[j]	0.50	
Olga	76	48	60.1	1.13	
Olympia	90	40	64.6	0.02	
Pinehill	97	43	70.3	0.06	
Pomeroy	99	40	68.4	1.46	
Port Townsend	81	48	61.4	0.05	
Quiniault	90	42	63.9	1.53	
Republic	97	35	63.6	0.11	
Rock Lake	.....	.....	.....	0.31	
Rosalia	98	35	65.8	0.33	
Sedro	85	38	61.6	0.35	
Sixprong	103	52	68.6	0.15	
Snoqualmie	88	39	63.8	0.22	
Stehekin	89	46	68.1	0.19	
Sunnyside	96	44	69.8	T.	
Touchet	104	44	74.0	0.33	
Twisp	99	42	69.0	0.48	
Union	89	40	65.2	0.10	
Vancouver	95	44	69.8	0.05	
Vashon	81	46	63.3	0.32	
Wahluke	101	50[h]	74.9[d]	T.	
Waterville	96	42	67.4	0.11	
Wenatchee (near)	94	50	71.0	0.67	
Wilbur	95	32	64.0	0.25	
Yale	94	39	65.9	T.	
Zindel	107	54	78.0	1.85	
West Virginia.					
Bancroft	93	61	78.0	6.02	
Bayard	86	50	70.0	6.56	
Beckley	86	60	75.2	3.92	
Bens Run	93	57	77.7	8.62	
Bluefield	87	58	73.8	6.35	
Burlington	90[k]	55[k]	72.5[k]	6.68	
Cairo	94	56	77.4	5.82	
Central	93	54	75.2	4.72	
Charleston	92	64	78.5	3.09	
Creston	94	57	76.4	2.98	
Cuba	92	52	75.4	2.18	
Elkhorn	89	60	74.2	5.42	
Fairmont	92	55	75.6	4.26	
Franklin	90	55	72.7	7.45	
Glenville	92	61	77.4	3.80	

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
West Virginia—Cont'd.	°	°	°	*Ins.*	*Ins.*
Grafton	92	56	75.4	3.07	
Green Sulphur Springs	90	54	75.5	6.00	
Harpers Ferry	.....	.....	.....	6.74	
Hinton	90*	64*	76.6*	4.62	
Huntington	93	57	77.9	4.20	
Leonard	81	60	71.8	6.05	
Lewisburg	89	57	74.2	3.79	
Logan	92	63	77.2	2.82	
Lost City	93	50	73.4	8.00	
Lost Creek	94	57	76.0	6.45	
Madison	93[3]	64[3]	79.2[3]	7.30	
Mannington	90	54	74.7	4.82	
Martinsburg	92	60	74.7	9.50	
Moorefield	94	54	74.9	4.98	
Mooresville	.....	.....	.....	3.41	
Morgantown	91	54	74.6	2.93	
Moundsville	92	53	76.1	3.21	
New Cumberland	93	47	74.0	4.68	
New Martinsville	94	54	77.2	3.61	
Nuttallburg	92	55	74.6	2.42	
Oceana	92	61	77.0	3.91	
Parsons	88	53	73.2	7.50	
Philippi	90	50	73.9	4.20	
Pickens	85	52	70.4	10.72	
Point Pleasant	93	57	77.8	3.14	
Powellton	95	61	77.6	8.12	
Princeton	.....	.....	.....	7.75	
Romney	96	61	78.4	7.64	
Rowlesburg	.....	.....	.....	5.00	
Ryan	93	57	76.0	2.79	
Smithfield	.....	.....	.....	3.17	
Southside	94	56	76.8	3.97	
Spencer	93	57	75.6	5.30	
Sutton	98	55	79.7	4.96	
Terra Alta	88	55	71.0	6.06	
Union	89	60	74.5	5.09	
Uppertract	92	56	73.6	7.03	
Wellsburg	86	53	73.0	6.53	
Weston	.....	.....	.....	3.39	
Wheeling	.....	.....	.....	4.36	
Williamson	93	65	78.4	6.48	
Wisconsin.					
Amherst	98	45	70.8	5.83	
Appleton Marsh	93	42	69.4	2.63	
Ashland	88	45	67.0	5.30	
Beloit	91	49	72.4	5.54	
Brodhead	92[2]	46[2]	73.0[2]	8.55	
Burnett	90	44	70.6	3.28	
Butternut	94	33	67.8	3.14	
Chilton	91	49	71.4	2.82	
Chippewa Falls	.....	.....	.....	4.06	
Downing	90	40	68.0	5.63	
Eau Claire	96	46	72.8	3.61	
Florence	91	38	65.5	4.64	
Fond du Lac	93	43	71.0	3.78	
Grand Rapids	91	44	70.6	2.43	
Grand River Locks	.....	.....	.....	6.30	
Grantsburg	96	39	68.2	4.08	
Hancock	94	43	71.0	2.36	
Harvey	92	47	72.0	5.99	
Hayward	93	35	65.8	4.73	
Hillsboro	94	41	70.2	1.82	
Koepenick	95	35	68.1	5.00	
Manitowoc	95	49	70.2	1.69	
Mauston	90	43	71.0	2.64	
Meadow Valley	95	41	70.5	2.62	
Medford	94	41	69.6	3.55	
Menasha	.....	.....	.....	1.37	
Merrill	95	43	69.3	8.53	
Minocqua	.....	.....	.....	4.33	
Mount Horeb	91	46	71.7	4.69	
Neillsville	98	44	72.3	3.05	
New London	93	43	70.9	4.01	
New Richmond	95	42	71.0	3.20	
Oconto	95	46	70.1	3.22	
Osceola	96	38	69.4	2.56	
Oshkosh	92	48	72.3	4.00	
Pine River	92[1]	43[1]	71.8[1]	3.19	
Portage	90	47	71.4	3.27	
Port Washington	91	50	70.4	2.52	
Prairie du Chien	97	44	74.8	6.28	
Prentice	91	32	68.2	4.68	
Racine	95	51	73.6	3.85	
Sheboygan	96	50	71.8	2.43	
Shullsburg	90	44	72.4	6.90	
Solon Springs	94	34	64.8	2.68	
Wisconsin—Cont'd.	°	°	°	*Ins.*	*Ins.*
Stanley	93	39	68.8	5.25	
Stevens Point	93	40	70.4	4.87	
Sturgeon Bay	92	42	69.2	3.88	
Valley Junction	93	40	69.2	3.68	
Viroqua	90	45	71.3	3.32	
Watertown	89	45	70.6	3.95	
Waukesha	.....	.....	.....	2.40	
Waupaca	95	45	72.5	3.70	
Wausau	94	45	69.6	2.84	T.
Whitehall	95	40	71.6	3.59	
Wyoming.					
Afton	89	34	60.2	2.93	
Alcova	103	40	71.2	1.70	
Barnum	.....	.....	.....	1.50	
Bedford	88	33	58.8	3.35	
Border	92	32	60.4	3.22	
Buffalo	97	35	65.1	2.47	
Cambria	.....	.....	.....	1.60	
Chugwater	91	39	65.0	1.61	
Clark	96	40	68.2	1.60	
Clear Creek Cabin	86	26	55.4	3.11	
Corbette	99	38	68.3	2.04	
Daniel	85	21	54.2	1.89	
Elk Mountain	.....	.....	.....	0.81	
Evanston	87	35	60.0	2.51	
Experiment Farm	.....	.....	.....	0.47	
Fayette	90	32	60.6	1.50	
Fort Washakie	95	36	66.3	1.60	
Gillette	102	47	71.6	1.98	
Granite Canyon	83	35	60.2	1.34	
Granite Springs	88[4]	41[4]	65.2[4]	1.97	
Green River	95	36	64.8	0.48	
Griggs	96	39	65.8	2.13	
Hatton	.....	.....	.....	1.29	
Hyattville	100	36	68.2	.....	
Jackson	89	30	58.4	2.13	
Kirtley	94	32	64.8	3.63	
Laramie	88	35	61.6	0.59	
Leo	85[e]	32[e]	62.2[e]	0.74	
Little Medicine	88	32	58.6	1.50	
Lolabama Ranch	85	30	55.4	2.97	
Moorecroft	99	34	69.3	1.48	
Moore	91	36	63.7	2.72	
Pathfinder	99	39	69.6	2.89	
Phillips	94	39	63.9	2.73	
Pine Bluff	95	41	66.2	1.72	
Pinedale	87	30	57.0	1.74	
Saratoga	90	36	63.0	1.15	
Shoshone Canyon	96	38	67.6	2.14	
South Pass City	90	22	57.2	1.14	
Wells	84	27	53.5	3.32	
Wheatland	102	43	73.6	1.25	
Yellowstone Pk. (F'tain)	84	27	54.8	1.50	
Yellowstone Pk. (G'd Cn.)	83	28	53.8	3.01	
Yellowstone Pk. (Lake)	80	28	52.6	1.23	
Yellowstone Pk. (Norris)	86	26	54.0	2.12	
Yellowstone Pk (Riv'side)	87	25	55.2	1.63	
Yellowstone Pk (Snake R)	90	20	54.6	3.16	
Yellowstone Pk. (Soda B.)	88	24	55.8	2.18	
Yellowstone Pk. (Thumb)	77[a]	23[a]	50.1[a]	.....	
Yellowstone Pk. (Up. B.)	85	26	54.6	1.70	
Porto Rico.					
Adjuntas	99	59	78.2	6.26	
Aguirre	95	73	84.1	1.21	
Albonita	88	69[b]	75.4[b]	2.02	
Anasco	94	67	79.8	11.60	
Arecibo	92[3]	61[3]	77.6[3]	.....	
Barros	90	63	76.6	4.75	
Bayamon	92	68	78.7	9.75	
Caguas	95	60	79.2	2.92	
Canovanas	90	73	81.4	6.56	
Cayey	90	60	76.0	1.39	
Coamo	98	67	83.1	1.04	
Corozal	92	53	77.8	1.60	
Fajardo	92	72	82.6	1.81	
Guanica	95	67	81.0	0.65	
Hacienda Colosa	91	67	79.3	10.08	
Hacienda Josefa	.....	.....	.....	1.60	
Isolina	90	63	76.0	8.19	
Juana Diaz	98	70	83.6	1.84	
Lares	91	60	77.8	13.82	
Las Cruces	91	61	78.2	10.24	
Las Marias	91	64	76.8	20.35	
Manati	95	68	81.0	6.24	
Maunabo	93	72	84.1	6.90	
Mayaguez	93	65	79.1	11.93	
Porto Rico—Cont'd.	°	°	°	*Ins.*	*Ins.*
Morovis	92	60	76.8	10.20	
Rio Blanco	91	69	80.4	5.06	
Rio Piedras	.....	.....	.....	5.81	
San German	95	67	80.4	5.22	
San Lorenzo	103	65	80.5	4.88	
San Salvador	88	62	75.0	6.64	
Santa Isabel	97	70	82.2	0.32	
Vieques	92	70	82.3	3.41	
Yabucoa	.....	.....	.....	6.49	
New Brunswick.					
St. John	81	48	63.0	1.00	
Nicaragua.					
Bluefields	90	72	80.4	26.24	

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Alaska.					
Central	.....	32	.....	4.82	
Fairbanks	83	40	60.4	2.82	
Fort Liscum	66	39	50.4	7.12	
Holy Cross Mission	72	37	55.4	1.97	
Juneau	77	44	57.6	3.58	
Kenai	70	34	53.0	4.41	
Rampart	83	34	59.1	1.86	
Sunrise	69	36	53.2	1.84	
Tyoonok	74	42	58.6	2.96	
California.					
Crockers	.....	.....	.....	T.	
Le Grande	117	52	82.4	0.00	
Pilot Creek	.....	.....	.....	0.00	
Indiana.					
Franklin	92	51	.....	3.47	
Idaho.					
Poplars	.....	.....	.....	T.	
New York.					
Windham	85	38	66.2	4.89	
South Dakota.					
Spearfish	95	33	64.2	1.06	
Porto Rico.					
Barros	92	64	76.6	5.55	
Caguas	93	63	78.0	9.42	
Coamo	93	68	80.0	1.24	
Yabucoa	.....	.....	.....	10.31	

EXPLANATION OF SIGNS.

• Extremes of temperature from observed readings of dry thermometer.

A numeral following the name of a station indicates the hours of observation from which the mean temperature was obtained, thus:

[1] Mean of 7 a. m. + 2 p. m. + 9 p. m. + 9 p. m. ÷ 4.
[2] Mean of 8 a. m. + 8 p. m. ÷ 2.
[3] Mean of 7 a. m. + 7 p. m. ÷ 2.
[4] Mean of 6 a. m. + 6 p. m. ÷ 2.
[5] Mean of 7 a. m. + 2 p. m. ÷ 2.
[6] Mean of readings at various hours reduced to true daily mean by special tables.

The absence of a numeral indicates that the mean temperature has been obtained from daily readings of the maximum and minimum thermometers.

An italic letter following the name of a station, as "Livingston *a*," "Livingston *b*," indicates that two or more observers, as the case may be, are reporting from the same station. A small roman letter following the name of a station, or in figure columns, indicates the number of days missing from the record; for instance, "[a]" denotes 14 days missing.

No note is made of breaks in the continuity of temperature records when the same do not exceed two days. All known breaks of whatever duration, in the precipitation record receive appropriate notice.

CORRECTIONS.

June, 1906, Michigan, Hillsdale, make mean temperature 66.7 instead of 67.0.

Utah, Loa, January to April, 1906, inclusive, cut out all precipitation values.

Oregon, Prospect, March to June, 1906, inclusive, cut out all maximum and mean temperatures.

TABLE III.—*Wind resultants, from observations at 8 a. m. and 8 p. m., daily, during the month of August, 1906.*

Stations.	Component direction from—				Resultant.	
	N.	S.	E.	W.	Direction from—	Duration.
New England.	*Hours.*	*Hours.*	*Hours.*	*Hours.*	°	*Hours.*
Eastport, Me	15	31	3	30	s. 59 w.	31
Portland, Me	14	27	6	27	s. 59 w.	25
Concord, N. H.†	13	11	5	12	n. 74 w.	7
Burlington, Vt.†	6	20	6	4	s. 8 e.	14
Northfield, Vt	18	34	8	14	s. 21 w.	17
Boston, Mass	13	23	19	23	s. 22 w.	11
Nantucket, Mass	11	27	19	24	s. 17 w.	17
Block Island, R. I	14	25	18	23	s. 24 w.	12
Providence, R. I	21	20	15	23	n. 83 w.	8
Hartford, Conn	22	30	7	12	s. 32 w.	9
New Haven, Conn	20	23	15	18	s. 45 w.	4
Middle Atlantic States.						
Albany, N. Y	15	34	11	9	s. 6 e.	19
Binghamton, N. Y.†	10	7	13	9	n. 53 e.	5
New York, N. Y	16	22	20	18	s. 18 e.	6
Harrisburg, Pa	14	16	19	20	s. 27 w.	2
Philadelphia, Pa	18	23	19	17	s. 22 e.	5
Scranton, Pa	18	19	22	19	s. 72 e.	3
Atlantic City, N. J	13	29	15	21	s. 21 w.	17
Cape May, N. J	12	32	18	9	s. 24 e.	22
Baltimore, Md	13	17	19	22	s. 37 w.	5
Washington, D. C	19	25	19	14	s. 40 e.	8
Lynchburg, Va	23	20	23	16	n. 67 e.	8
Mount Weather, Va	14	19	21	21	s.	5
Norfolk, Va	1	39	16	14	s. 3 e.	38
Richmond, Va	15	31	19	8	s. 34 e.	19
Wytheville, Va	17	11	20	26	n. 45 w.	8
South Atlantic States.						
Asheville, N. C	16	30	13	12	s. 4 e.	14
Charlotte, N. C	12	29	19	17	s. 7 e.	17
Hatteras, N. C	3	35	9	32	s. 36 w.	39
Raleigh, N. C	11	30	20	19	s. 3 e.	19
Wilmington, N. C	7	32	14	24	n. 22 w.	27
Charleston, S. C	3	39	19	9	s. 16 e.	37
Columbia, S. C	13	30	15	16	s. 3 w.	17
Augusta, Ga	11	30	23	14	s. 25 e.	21
Savannah, Ga	10	35	5	22	s. 34 w.	30
Jacksonville, Fla	4	34	24	14	s. 18 e.	32
Florida Peninsula.						
Jupiter, Fla	2	38	21	20	s. 2 e.	36
Key West, Fla	8	20	39	5	s. 71 e.	36
Tampa, Fla	18	17	29	13	n. 87 e.	16
Eastern Gulf States.						
Atlanta, Ga	15	17	23	21	s. 45 e.	3
Macon, Ga.†	7	16	11	5	s. 34 e.	11
Thomasville, Ga	7	27	29	11	s. 42 e.	27
Pensacola, Fla.†	16	2	10	8	n. 8 e.	14
Anniston, Ala	15	29	20	8	s. 41 e.	18
Birmingham, Ala	16	16	23	19	e.	4
Mobile, Ala	28	16	16	15	n. 5 e.	12
Montgomery, Ala	18	18	18	20	w.	2
Meridian, Miss	18	26	17	20	s. 21 w.	8
Vicksburg, Miss	20	19	18	19	n. 45 w.	1
New Orleans, La	15	19	16	26	s. 68 w.	11
Western Gulf States.						
Shreveport, La	12	26	13	24	s. 38 w.	18
Bentonville, Ark.†	5	21	9	3	s. 21 e.	17
Fort Smith, Ark	12	8	42	8	n. 83 e.	34
Little Rock, Ark	22	20	15	22	n. 74 w.	7
Corpus Christi, Tex	6	38	36	1	s. 48 e.	47
Fort Worth, Tex	5	39	18	17	s. 2 e.	34
Galveston, Tex	5	37	24	8	s. 27 e.	36
Palestine, Tex	8	37	18	11	s. 14 e.	30
San Antonio, Tex	10	29	38	1	s. 63 e.	42
Taylor, Tex.†	3	20	8	2	s. 19 e.	18
Ohio Valley and Tennessee.						
Chattanooga, Tenn	15	25	8	29	s. 65 w.	23
Knoxville, Tenn	20	25	15	18	s. 31 w.	6
Memphis, Tenn	24	19	15	18	n. 31 w.	6
Nashville, Tenn	13	21	15	28	s. 58 w.	15
Lexington, Ky.†	6	15	7	7	s.	9
Louisville, Ky	16	31	15	14	s. 4 e.	15
Evansville, Ind.†	8	14	9	7	s. 18 e.	6
Indianapolis, Ind	19	24	21	17	s. 39 e.	6
Cincinnati, Ohio	21	18	27	12	n. 79 e.	15
Columbus, Ohio	16	25	19	14	s. 29 e.	10
Pittsburg, Pa	22	17	22	19	n. 31 e.	6
Parkersburg, W. Va	17	21	17	19	s. 27 w.	4
Elkins, W. Va	19	23	18	18	s.	4
Lower Lake Region.						
Buffalo, N. Y	9	23	23	18	s. 20 e.	15
Canton, N. Y.†	5	14	7	12	s. 29 w.	10
Oswego, N. Y	10	35	15	16	s. 2 w.	25
Rochester, N. Y	15	25	15	21	s. 31 w.	12
Syracuse, N. Y	7	36	10	15	s. 10 w.	29
Erie, Pa	14	26	19	20	s. 5 w.	12
Cleveland, Ohio	15	28	25	12	s. 45 e.	18
Sandusky, Ohio†	4	14	5	14	s. 42 w.	14
Toledo, Ohio	12	16	18	26	s. 63 w.	9
Detroit, Mich	16	18	18	22	s. 63 w.	4
Upper Lake Region.						
Alpena, Mich	17	19	20	21	s. 27 w.	2
Escanaba, Mich	24	21	16	16	n.	3
Grand Haven, Mich	13	23	24	19	s. 27 e.	11
Grand Rapids, Mich	15	16	23	20	s. 72 e.	3
Houghton, Mich.†	5	4	18	9	n. 84 e.	9
Marquette, Mich	22	17	17	20	n. 31 w.	6
Port Huron, Mich	13	23	23	18	s. 27 e.	11
Sault Ste. Marie, Mich	13	13	29	20	e.	9
Chicago, Ill	10	17	24	22	s. 16 e.	7
Milwaukee, Wis	17	13	22	26	n. 45 w.	6
Green Bay, Wis	16	22	21	18	s. 27 e.	7
Duluth, Minn	30	5	28	19	n. 20 e.	27

Stations.	Component direction from—				Resultant.	
	N.	S.	E.	W.	Direction from—	Duration.
North Dakota.	*Hours.*	*Hours.*	*Hours.*	*Hours.*	°	*Hours.*
Moorhead, Minn	25	21	22	10	n. 72 e.	13
Bismarck, N. Dak	21	16	26	12	n. 70 e.	15
Devils Lake, N. Dak	17	20	24	20	s. 53 e.	5
Williston, N. Dak	17	23	23	16	s. 49 e.	9
Upper Mississippi Valley.						
Minneapolis, Minn.*	9	11	11	7	s. 63 e.	4
Madison, Wis	12	27	18	19	s. 4 w.	15
Charles City, Iowa	15	25	19	16	s. 17 e.	10
St. Paul, Minn	21	22	21	9	s. 85 e.	12
La Crosse, Wis.†	7	16	6	5	s. 6 e.	9
Davenport, Iowa	12	16	17	28	s. 70 w.	12
Des Moines, Iowa	15	27	12	21	s. 37 w.	15
Dubuque, Iowa	10	28	21	17	s. 13 e.	18
Keokuk, Iowa	7	32	14	24	s. 22 w.	27
Cairo, Ill	15	23	17	19	s. 14 w.	8
La Salle, Ill.†	9	10	10	13	s. 72 w.	3
Peoria, Ill	17	30	14	15	s. 13 w.	13
Springfield, Ill	11	30	16	18	s. 6 w.	19
Hannibal, Mo.†	4	12	4	16	s. 56 w.	14
St. Louis, Mo	13	26	15	19	s. 17 w.	14
Missouri Valley.						
Columbia, Mo.*	5	19	5	7	s. 8 w.	14
Kansas City, Mo	12	33	18	17	s. 3 e.	21
Springfield, Mo	11	27	16	11	s. 17 e.	17
Iola, Kans.†	4	23	4	6	s. 6 w.	19
Topeka, Kans.*	5	21	2	5	s. 11 w.	16
Lincoln, Nebr	16	30	19	11	s. 30 e.	16
Omaha, Nebr	17	29	15	15	s.	12
Valentine, Nebr	19	20	16	16	s.	1
Sioux City, Iowa †	11	13	9	6	s. 56 e.	4
Pierre, S. Dak	18	21	31	10	s. 82 e.	21
Huron, S. Dak	25	18	22	11	n. 58 e.	13
Yankton, S. Dak. †	7	9	9	9	s.	2
Northern Slope.						
Havre, Mont.	15	12	27	24	n. 45 e.	4
Miles City, Mont	22	14	26	13	n. 58 e.	15
Helena, Mont	16	21	9	29	s. 76 w.	21
Kalispell, Mont	17	10	15	31	n. 66 w.	18
Rapid City, S. Dak	23	16	19	22	n. 23 w.	8
Cheyenne, Wyo	24	19	8	27	n. 75 w.	20
Lander, Wyo	21	23	13	20	s. 74 w.	7
Yellowstone Park, Wyo	18	31	2	25	s. 61 w.	26
North Platte, Nebr	11	30	25	12	s. 34 e.	23
Middle Slope.						
Denver, Colo	20	26	15	12	s. 27 e.	7
Pueblo, Colo	28	16	16	18	n. 9 w.	12
Concordia, Kans	11	30	13	8	s. 15 e.	20
Dodge, Kans	13	34	29	4	s. 50 e.	33
Wichita, Kans	7	44	16	4	s. 18 e.	39
Oklahoma, Okla	9	47	11	2	s. 13 e.	39
Southern Slope.						
Abilene, Tex	5	48	17	1	s. 21 e.	46
Amarillo, Tex	7	35	30	3	s. 44 e.	39
Del Rio, Tex†	1	6	28	1	s. 80 e.	28
Roswell, N. Mex.	11	31	23	13	s. 27 e.	22
Southern Plateau.						
El Paso, Tex	13	9	33	18	n. 75 e.	16
Santa Fe, N. Mex	17	19	36	9	s. 86 e.	27
Flagstaff, Ariz	24	10	9	28	n. 54 w.	24
Phoenix, Ariz	11	13	35	15	s. 84 e.	20
Yuma, Ariz	11	26	21	17	s. 15 e.	16
Independence, Cal	18	22	21	20	s. 14 e.	4
Middle Plateau.						
Reno, Nev	5	20	6	43	s. 68 w.	40
Tonopah, Nev	8	22	27	21	s. 23 e.	15
Winnemucca, Nev	21	15	14	28	n. 67 w.	15
Modena, Utah	6	18	10	39	s. 68 w.	31
Salt Lake City, Utah	22	19	23	14	n. 72 e.	9
Durango, Colo	31	10	11	27	n. 37 w.	26
Grand Junction, Colo	14	13	24	22	n. 63 e.	2
Northern Plateau.						
Baker City, Oreg	22	29	2	18	s. 66 w.	18
Boise, Idaho	18	20	19	23	s. 63 w.	4
Lewiston, Idaho†	0	6	27	1	s. 77 e.	27
Pocatello, Idaho	7	23	28	18	s. 32 e.	19
Spokane, Wash	16	24	19	20	s. 7 w.	8
Walla Walla, Wash	5	34	12	18	s. 12 w.	30
North Pacific Coast Region.						
North Head, Wash	33	11	6	33	n. 51 w.	35
Port Crescent, Wash.*	10	7	1	21	n. 81 w.	20
Seattle, Wash	30	13	14	21	n. 22 w.	18
Tacoma, Wash	32	9	4	24	n. 41 w.	30
Tatoosh Island, Wash	1	40	5	30	s. 33 w.	46
Portland, Oreg	29	11	8	31	n. 52 w.	29
Roseburg, Oreg	40	1	11	18	n. 10 w.	40
Middle Pacific Coast Region.						
Eureka, Cal	28	15	3	27	n. 62 w.	27
Mount Tamalpais, Cal	19	8	1	48	n. 77 w.	48
Red Bluff, Cal	10	31	26	15	s. 28 e.	24
Sacramento, Cal	3	49	14	5	s. 11 e.	47
San Francisco, Cal	0	10	0	56	s. 70 w.	57
San Jose, Cal.†	13	1	0	24	n. 63 w.	27
Southeast Farallon, Cal.*	16	7	0	19	n. 65 w.	21
South Pacific Coast Region.						
Fresno, Cal	38	1	1	36	n. 47 w.	51
Los Angeles, Cal	7	21	9	36	s. 63 w.	30
San Diego, Cal	30	11	1	33	n. 59 w.	37
San Luis Obispo, Cal	22	14	7	32	n. 72 w.	26
West Indies						
Grand Turk, W.I.†	6	1	28	0	n. 80 e.	28
San Juan, Porto Rico	1	12	56	0	s. 79 e.	57

* From observations at 8 p. m. only. † From observations at 8 a. m. only.

TABLE IV.—*Accumulated amounts of precipitation for each 5 minutes, for storms in which the rate of fall equaled or exceeded 0.25 in any 5 minutes, or 0.75 in 1 hour, during August, 1906, at all stations furnished with self-registering gages.*

Stations.	Date.	Total duration.		Total amount of precipitation.	Excessive rate.		Amount before excessive began.	Depths of precipitation (in inches) during periods of time indicated.													
		From—	To—		Began—	Ended—		5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
	1	2	3	4	5	6	7														
Abilene, Tex	31-1	8:15 p. m.	1:20 a. m.	1.79	8:35 p. m.	8:55 p. m.	0.03	0.07	0.35	0.63	0.74	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Albany, N. Y	6	5:20 p. m.	7:50 p. m.	0.62	5:32 p. m.	5:50 p. m.	0.01	0.21	0.42	0.52	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Alpena, Mich	10	11:25 a. m.	2:30 p. m.	1.11	11:29 a. m.	11:45 a. m.	0.02	0.14	0.48	0.79	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	20	1:22 p. m.	2:05 p. m.	0.65	1:28 p. m.	1:52 p. m.	0.04	0.14	0.22	0.33	0.50	0.61	.....	.....	.....	.....	.....	.....	.....	.....	.....
Amarillo, Tex	7	5:25 p. m.	8:45 p. m.	4.02	5:25 p. m. 6:15 p. m. 7:05 p. m.	6:15 p. m. 7:05 p. m. 8:18 p. m.	0.00	0.20 1.32 2.17	0.40 1.38 2.33	0.61 1.46 2.40	0.83 1.61 2.44	0.90 1.70 2.47	1.06 1.80 2.54	1.14 1.87 2.65	1.22 1.95 2.75	1.23 2.01 2.85	1.26 2.09 3.25	.....	.....	.....	.....
Asheville, N. C	13	4:46 p. m.	10:00 p. m.	0.47	4:48 p. m.	4:58 p. m.	0.01	0.22	0.34	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	26	1:27 p. m.	3:05 p. m.	0.57	1:46 p. m.	2:01 p. m.	0.09	0.15	0.32	0.40	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Atlanta, Ga	28-29	.....	.....	0.72	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.35	.....	.....	.....
Atlantic City, N. J	12	1:45 p. m.	2:55 p. m.	1.96	1:45 p. m.	2:44 p. m.	0.00	0.06	0.16	0.23	0.39	0.58	0.69	1.08	1.48	1.68	1.86	1.95	.....	.....	.....
Do	24-25	1:10 p. m.	3:00 p. m.	2.22	4:18 p. m.	4:55 p. m.	0.23	0.14	0.46	0.68	0.83	0.93	0.98	1.03	1.07	.....	.....	.....	.....	.....	.....
Augusta, Ga	1	10:00 p. m.	D. N.	3.28	10:04 p. m.	11:39 p. m.	0.01	0.27	0.68	0.97	1.07	1.18	1.35	1.42	1.62	1.83	2.05	2.77	3.24	.....	.....
Do	22	2:46 p. m.	3:40 p. m.	0.88	2:53 p. m.	3:18 p. m.	0.01	0.14	0.43	0.63	0.73	0.78	.....	.....	.....	.....	.....	.....	.....	.....	.....
Baltimore, Md	2	1:05 p. m.	7:40 p. m.	1.05	2:25 p. m.	3:05 p. m.	0.18	0.09	0.17	0.23	0.34	0.36	0.41	0.50	0.66	.....	.....	.....	.....	.....	.....
Binghamton, N. Y	7	4:50 p. m.	8:30 p. m.	1.52	4:54 p. m.	5:07 p. m.	0.01	0.45	0.90	1.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Birmingham, Ala	13	3:02 p. m.	6:48 p. m.	2.57	3:05 p. m.	4:35 p. m.	0.01	0.24	0.28	0.29	0.54	0.74	0.74	0.75	0.77	0.82	0.96	1.64	2.23	2.41	.....
Bismarck, N. Dak	1	.....	.....	0.38	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.38	.....	.....	.....
Block Island, R. I	23-24	11:45 p. m.	1:20 a. m.	1.00	12:17 a. m.	12:39 a. m.	0.03	0.08	0.26	0.44	0.78	0.87	.....	.....	.....	.....	.....	.....	.....	.....	.....
Boise, Idaho	22	.....	.....	0.06	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.06	.....	.....	.....
Boston, Mass	4	.....	.....	0.54	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.46	.....	.....	.....
Buffalo, N. Y	27	.....	.....	0.50	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.30	.....	.....	.....
Cairo, Ill	7	3:23 p. m.	5:00 p. m.	1.47	3:30 p. m.	3:55 p. m.	0.01	0.10	0.29	0.81	1.02	1.33	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	14	7:30 a. m.	12:41 p. m.	1.23	8:54 a. m.	9:29 a. m.	0.04	0.13	0.22	0.33	0.48	0.63	0.72	0.80	.....	.....	.....	.....	.....	.....	.....
Charles City, Iowa	4	12:05 p. m.	1:30 p. m.	1.19	12:28 p. m.	12:59 p. m.	0.02	0.11	0.17	0.28	0.50	0.95	1.10	1.14	.....	.....	.....	.....	.....	.....	.....
Do	7	7:26 p. m.	8:55 p. m.	1.39	7:40 p. m.	8:27 p. m.	0.03	0.06	0.11	0.20	0.30	0.35	0.41	0.64	1.08	1.34	1.37	.....	.....	.....	.....
Charleston, S. C	2	8:01 a. m.	10:20 a. m.	3.32	8:36 a. m.	10:18 a. m.	0.06	0.09	0.20	0.27	0.40	0.64	0.82	0.95	1.09	1.29	1.48	1.74	2.48	3.23	3.26
Do	27	D. N.	D. N.	1.66	2:11 a. m.	2:47 a. m.	0.30	0.13	0.20	0.25	0.52	0.88	1.18	1.33	1.34	.....	.....	.....	.....	.....	.....
Charlotte, N. C	16	6:07 p. m.	7:35 p. m.	1.49	6:07 p. m.	6:55 p. m.	0.00	0.31	0.64	0.94	1.09	1.09	1.10	1.11	1.19	1.34	1.46	.....	.....	.....	.....
Do	30	D. N.	3:40 p. m.	2.48	5:20 a. m.	5:55 a. m.	0.13	0.18	0.36	0.41	0.50	0.76	0.99	1.09	.....	.....	.....	.....	.....	.....	.....
Chattanooga, Tenn	27	.....	.....	0.58	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.46	.....	.....	.....
Cheyenne, Wyo	22	.....	.....	0.20	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.16	.....	.....	.....
Chicago, Ill	21	.....	.....	0.14	.....	.....	.....	.....	.....	.....	.....	.....	0.14	.....	.....	.....	.....	.....	.....	.....	.....
Cincinnati, Ohio	17	10:53 a. m.	12:02 p. m.	1.19	11:02 a. m.	11:32 a. m.	0.02	0.07	0.19	0.40	0.64	0.77	0.83	0.91	0.92	1.01	1.17	.....	.....	.....	.....
Do	26	12:40 p. m.	1:45 p. m.	0.85	12:47 p. m.	1:12 p. m.	0.03	0.16	0.36	0.54	0.71	0.78	.....	.....	.....	.....	.....	.....	.....	.....	.....
Cleveland, Ohio	8	.....	.....	1.55	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.46	.....	.....	.....
Columbia, Mo	5	.....	.....	0.76	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.40	.....	.....	.....
Columbia, S. C	12	3:10 p. m.	7:40 p. m.	1.95	5:03 p. m.	6:03 p. m.	0.03	0.11	0.39	0.49	0.55	0.70	0.99	1.22	1.55	1.68	1.73	1.85	.....	.....	.....
Do	14	4:45 p. m.	9:30 p. m.	1.45	5:19 p. m.	5:44 p. m.	0.19	0.28	0.53	0.68	0.74	0.80	.....	.....	.....	.....	.....	.....	.....	.....	.....
Columbus, Ohio	3	11:30 a. m.	12:40 p. m.	0.96	11:46 a. m.	12:36 p. m.	0.04	0.05	0.26	0.49	0.58	0.71	0.79	0.81	0.81	0.87	0.92	.....	.....	.....	.....
Do	17	3:22 p. m.	4:40 p. m.	1.02	3:32 p. m.	4:22 p. m.	0.02	0.19	0.43	0.44	0.44	0.52	0.66	0.67	0.73	0.86	0.97	.....	.....	.....	.....
Concord, N. H	11	7:23 p. m.	8:05 p. m.	0.62	7:23 p. m.	7:47 p. m.	0.00	0.09	0.20	0.35	0.56	0.60	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	23	6:10 p. m.	8:43 p. m.	0.97	6:14 p. m.	6:41 p. m.	0.01	0.06	0.19	0.49	0.65	0.74	0.79	.....	.....	.....	.....	.....	.....	.....	.....
Corpus Christi, Tex	19	12:02 a. m.	4:37 a. m.	0.66	2:39 a. m.	2:57 a. m.	0.03	0.09	0.21	0.39	0.56	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Davenport, Iowa	5	8:40 p. m.	D. N.	0.69	9:13 p. m.	9:38 p. m.	0.01	0.21	0.26	0.62	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Del Rio, Tex	10	11:20 p. m.	11:55 p. m.	0.71	11:22 p. m.	11:32 p. m.	0.01	0.28	0.58	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Denver, Colo	13	.....	.....	0.20	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.15	.....	.....	.....
Des Moines, Iowa	15	6:17 a. m.	7:20 a. m.	1.01	6:29 a. m.	7:14 a. m.	0.01	0.09	0.16	0.23	0.27	0.31	0.33	0.51	0.73	0.98	.....	.....	.....	.....	.....
Do	15	7:55 a. m.	11:30 a. m.	2.42	7:57 a. m.	9:14 a. m.	0.01	0.07	0.13	0.31	0.33	0.33	0.37	0.52	0.71	0.86	1.07	1.46	2.16	.....	.....
Detroit, Mich	23	2:30 p. m.	4:15 p. m.	1.99	2:35 p. m.	3:45 p. m.	0.02	0.23	0.62	0.88	1.17	1.25	1.32	1.34	1.40	1.51	1.58	1.70	1.95	.....	.....
Devils Lake, N. Dak	20	.....	.....	0.23	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.07	.....	.....	.....
Dodge, Kans	30-31	8:45 p. m.	5:48 a. m.	2.26	8:50 p. m.	9:35 p. m.	0.01	0.10	0.20	0.39	0.49	0.61	0.68	0.80	0.91	0.99	.....	.....	.....	.....	.....
Dubuque, Iowa	4	5:37 p. m.	6:46 p. m.	1.01	5:45 p. m.	6:14 p. m.	0.01	0.11	0.28	0.50	0.82	0.93	0.98	.....	.....	.....	.....	.....	.....	.....	.....
Duluth, Minn	24-25	9:10 a. m.	11:55 a. m.	2.14	5:27 a. m.	5:42 a. m.	1.52	0.12	0.29	0.44	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Eastport, Me	23	.....	.....	0.72	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.43	.....	.....	.....
Elkins, W. Va	12	7:00 a. m.	7:15 a. m.	0.59	7:03 a. m.	7:09 a. m.	0.01	0.55	0.58	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	17	12:55 p. m.	2:40 p. m.	1.10	1:54 p. m.	2:24 p. m.	0.37	0.14	0.37	0.53	0.63	0.68	0.72	.....	.....	.....	.....	.....	.....	.....	.....
El Paso, Tex	22	4:00 p. m.	11:00 p. m.	2.45	8:06 p. m.	10:06 p. m.	0.15	0.16	0.36	0.42	0.55	0.67	0.76	0.85	0.94	1.03	1.12	1.29	1.79	2.10	2.30
Erie, Pa	8	D. N.	8:35 a. m.	2.18	5:57 a. m.	6:50 a. m.	0.56	0.06	0.20	0.33	0.44	0.53	0.60	0.71	0.92	1.12	1.16	.....	.....	.....	.....
Escanaba, Mich	9	6:15 a. m.	11:00 p. m.	1.51	8:30 a. m.	8:38 a. m.	0.41	0.27	0.43	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Evansville, Ind	14	1:20 p. m.	4:00 p. m.	2.00	1:41 p. m.	2:30 p. m.	0.02	0.29	0.54	0.82	0.96	1.18	1.43	1.58	1.76	1.88	1.94	.....	.....	.....	.....
Fort Smith, Ark	24	5:50 a. m.	12:20 p. m.	1.40	5:54 a. m.	6:18 a. m.	0.01	0.19	0.33	0.44	0.56	0.68	.....	.....	.....	.....	.....	.....	.....	.....	.....
Fort Worth, Tex	11	2:45 a. m.	11:00 a. m.	3.57	2:55 a. m.	4:51 a. m.	T.	0.12	0.41	0.48	0.53	0.53	0.53	0.60	0.81	1.01	1.26	1.41	1.97	2.29	2.54
Galveston, Tex	20	7:15 a. m.	1:30 p. m.	0.76	7:17 a. m.	7:26 a. m.	0.01	0.23	0.35	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Grand Haven, Mich	9	5:40 a. m.	6:45 a. m.	1.34	5:55 a. m.	6:28 a. m.	0.02	0.12	0.19	0.34	0.64	1.06	1.23	1.31	.....	.....	.....	.....	.....	.....	.....
Grand Rapids, Mich	19	7:40 a. m.	9:18 a. m.	0.60	8:19 a. m.	8:42 a. m.	0.09	0.12	0.24	0.37	0.44	0.48	.....	.....	.....	.....	.....	.....	.....	.....	.....
Green Bay, Wis	9	10:45 a. m.	11:45 a. m.	2.11	10:45 a. m.	11:22 a. m.	0.00	0.23	0.60	0.92	1.29	1.59	1.81	2.03	2.08	.....	.....	.....	.....	.....	.....
Do	22	6:33 p. m.	8:40 p. m.	1.53	6:42 p. m.	7:11 p. m.	0.01	0.09	0.39	0.72	1.05	1.21	1.29	.....	.....	.....	.....	.....	.....	.....	.....
Do	25	5:45 p. m.	8:30 p. m.	1.76	6:24 p. m.	6:50 p. m.	0.09	0.15	0.34	0.49	0.80	1.07	1.09	.....	.....	.....	.....	.....	.....	.....	.....
Hannibal, Mo	17-18	9:00 p. m.	6:50 a. m.	2.43	1:57 a. m.	2:26 a. m.	0.04	0.35	0.80	1.33	1.63	1.81	1.90	.....	.....	.....	.....	.....	.....	.....	.....
Harrisburg, Pa	6	1:57 p. m.	3:15 p. m.	1.41	2:09 p. m.	2:54 p. m.	0.03	0.18	0.44	0.65	0.77	0.84	0.92	1.17	1.25	1.36	.....	.....	.....	.....	.....
Hartford, Conn	23	10:09 p. m.	D. N.	0.76	10:12 p. m.	10:24 p. m.	0.01	0.28	0.66	0.71	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	27	6:30 p. m.	9:30 p. m.	1.03	6:40 p. m.	7:20 p. m.	0.01	0.10	0.22	0.28	0.37	0.42	0.51	0.65	0.74	.....	.....	.....	.....	.....	.....
Hatteras, N. C	17	5:45 a. m.	7:20 a. m.	0.91	5:55 a. m.	6:24 a. m.	0.01	0.11	0.23	0.33	0.67	0.73	0.82	.....	.....	.....	.....	.....	.....	.....	.....
Huron, S. Dak	1	6:03 p. m.	10:15 p. m.	1.30	8:56 p. m.	9:52 p. m.	0.10	0.10	0.23	0.31	0.42	0.58	0.59	0.66	0.83	1.00	1.10	1.18	.....	.....	.....
Indianapolis, Ind	19	4:10 p. m.	5:25 p. m.	1.60	4:13 p. m.	5:07 p. m.	0.01	0.22	0.52	0.82	0.94	0.94	0.97	1.14	1.27	1.42	1.51	1.59	.....	.....	.....
Iola, Kans	3	3:39 p. m.	7:20 p. m.	0.50	3:54 p. m.	4:09 p. m.	0.06	0.25	0.37	0.43	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Jacksonville, Fla	27	3:30 p. m.	7:55 p. m.	2.44	4:28 p. m.	5:28 p. m.	0.08	0.11	0.20	0.30	0.47	0.64	1.06	1.34	1.68	1.88	2.02	2.20	.....	.....	.....
Jupiter, Fla	13	5:20 a. m.	7:10 a. m.	1.29	5:26 a. m.	6:06 a. m.	0.02	0.13	0.24	0.42	0.61	0.80	0.94	1.05	1.18	.....	.....	.....	.....	.....	.....
Do	26	10:10 a. m.	4:00 p. m.	1.22	11:59 a. m.	12:30 p. m.	0.05	0.09	0.21	0.24	0.46	0.68	0.84	0.92	0.99	.....	.....	.....	.....	.....	.....
Kansas City, Mo	23	4:10 a. m.	7:25 a. m.	5.93	4:21 a. m.	6:01 a. m.	0.03	0.22	0.60	1.02	1.52	2.02	2.57	3.14	3.67	4.01	4.32	4.74	5.45	5.74	.....
Key West, Fla	14	.....	.....	0.46	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.43	.....	.....	.....
Knoxville, Tenn	9	.....	.....	0.42	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.42	.....	.....	.....
La Crosse, Wis	9	12:30 p. m.	2:40 p. m.	1.18	12:43 p. m.	1:39 p. m.	0.01	0.14	0.20	0.27	0.41	0.53	0.58	0.61	0.66	0.82	0.99	1.11	.....	.....	.....
Do	21-22	8:10 p. m.	D. N.	1.98	1:47 a. m.	2:13 a. m.	0.73	0.13	0.34	0.50	0.58	0.64	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	25	D. N.	D. N.	0.79	4:38 a. m.	5:08 a. m.	0.07	0.22	0.33	0.39	0.49	0.65	0.70	.....	.....	.....	.....	.....	.....	.....	.....
La Salle, Ill	24	7:28 p. m.	11:15 p. m.	2.65	7:35 p. m. 9:37 p. m.	8:10 p. m. 9:57 p. m.	0.02 1.68	0.13 0.17	0.35 0.46	0.57 0.74	0.85 0.96	1.10	1.36	1.56	.....	.....	.....	.....	.....	.....	.....
Lexington, Ky	7	10:10 a. m.	5:00 p. m.	1.66	11:06 a. m.	11:38 a. m.	0.17	0.13	0.22	0.33	0.49	0.75	0.89	0.95	.....	.....	.....	.....	.....	.....	.....
Do	13	12:15 p. m.	1:49 p. m.	1.12	1:05 p. m.	1:47 p. m.	0.01	0.11	0.17	0.35	0.52	0.68	0.89	1.02	1.07	1.11	.....	.....	.....	.....	.....
Lincoln, Nebr	2	3:18 p. m.	6:00 p. m.	1.06	3:22 p. m.	3:38 p. m.	0.01	0.34	0.58	0.73	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	4	9:42 a. m.	11:15 a. m.	0.65	10:07 a. m.	10:20 a. m.	0.10	0.14	0.29	0.42	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Little Rock, Ark	11	12:10 a. m.	3:00 a. m.	1.28	12:47 a. m.	1:52 a. m.	0.10	0.11	0.30	0.40	0.48	0.55	0.63	0.69	0.73	0.78	0.84	1.02	.....	.....	.....
Los Angeles, Cal	20	.....	.....	0.03	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Louisville, Ky	26	5:50 p. m.	6:33 p. m.	0.41	5:58 p. m.	6:14 p. m.	0.02	0.11	0.28	0.38	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Lynchburg, Va	2	1:10 p. m.	2:05 p. m.	0.54	1:35 p. m.	1:45 p. m.	0.02	0.24	0.44	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	28	10:00 a. m.	9:40 p. m.	1.14	7:56 p. m.	8:17 p. m.	0.29	0.09	0.25	0.40	0.49	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Macon, Ga	21	6:40 p. m.	7:55 p. m.	1.88	6:45 p. m.	7:10 p. m.	0.01	0.10	0.50	1.02	1.43	1.64	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	22	2:25 p. m.	3:50 p. m.	0.78	2:38 p. m.	2:48 p. m.	0.04	0.34	0.66	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Madison, Wis	8	5:00 p. m.	8:45 p. m.	4.96	5:24 p. m.	6:56 p. m.	0.01	0.21	0.74	1.29	1.58	1.82	2.09	2.29	2.50	2.85	3.19	3.61	4.54	4.84	.....

TABLE IV.—*Accumulated amounts of precipitation for each 5 minutes, etc.*—Continued.

Stations.	Date.	Total duration. From—	Total duration. To—	Total amount of precipitation.	Excessive rate. Began—	Excessive rate. Ended—	Amount before excessive began.	Depths of precipitation (in inches) during periods of time indicated. 5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
	1	2	3	4	5	6	7														
Marquette, Mich.	20–21	10:27 p. m.	4:10 a. m.	0.52	10:57 p. m.	11:11 p. m.	0.04	0.13	0.40	0.46	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Memphis, Tenn	6	2:55 p. m.	3:35 p. m.	0.42	3:04 p. m.	3:15 p. m.	0.02	0.26	0.34	0.37	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Meridian, Miss.	11	11:44 a. m.	4:00 p. m.	1.60	11:45 a. m.	12:30 p. m.	0.01	0.12	0.17	0.18	0.18	0.20	0.39	0.82	1.32	1.43	.....	.....	.....	.....	.....
Do	13	1:40 p. m.	6:25 p. m.	3.92	1:42 p. m.	2:45 p. m.	0.01	0.17	0.38	0.76	1.25	1.81	2.28	2.53	2.73	2.89	3.06	3.63	3.74	.....	.....
Do	14	1:27 p. m.	2:20 p. m.	1.03	1:40 p. m.	2:05 p. m.	0.01	0.07	0.24	0.57	0.89	0.99	.....	.....	.....	.....	.....	.....	.....	.....	.....
Milwaukee, Wis.	22	11:15 a. m.	3:10 p. m.	1.94	§11:20 a. m.	12:20 p. m.	0.01	0.11	0.18	0.29	0.37	0.49	0.72	0.94	1.09	1.09	1.11	1.34	.....	.....	.....
					‖ 2:33 p. m.	2:43 p. m.	1.57	0.20	0.31	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Minneapolis, Minn.	22–23	9:05 p. m.	D. N.	0.66	9:10 p. m.	9:28 p. m.	0.01	0.17	0.25	0.37	0.54	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Montgomery, Ala.	10	5:30 p. m.	7:25 p. m.	1.02	6:11 p. m.	6:59 p. m.	0.08	0.26	0.35	0.39	0.41	0.53	0.68	0.76	0.81	0.86	0.92	.....	.....	.....	.....
Mount Weather, Va.	27	4:50 p. m.	D. N.	2.13	4:58 p. m.	5:34 p. m.	0.02	0.30	0.71	0.90	1.02	1.14	1.27	1.38	1.43	.....	.....	.....	.....	.....	.....
Nantucket, Mass	31–1	11:10 p. m.	7:20 a. m.	3.88	1:37 a. m.	2:17 a. m.	0.05	0.09	0.16	0.28	0.38	0.58	0.69	0.88	0.94	.....	.....	.....	.....	.....	.....
Do	8	2:50 a. m.	6:20 p. m.	1.59	2:16 p. m.	3:20 p. m.	0.55	0.06	0.14	0.20	0.25	0.31	0.44	0.49	0.58	0.69	0.74	0.85	1.00	.....	.....
Do	24	12:10 a. m.	4:15 a. m.	0.56	12:54 a. m.	1:12 a. m.	0.01	0.13	0.29	0.39	0.46	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Nashville, Tenn.	3	11:55 a. m.	12:40 p. m.	0.58	12:02 p. m.	12:23 p. m.	0.01	0.19	0.40	0.49	0.56	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	11	12:10 p. m.	1:50 p. m.	0.87	12:44 p. m.	1:05 p. m.	0.31	0.10	0.20	0.40	0.50	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
New Haven, Conn.	3–4	10:45 p. m.	4:10 a. m.	0.50	3:14 a. m.	3:29 a. m.	0.06	0.08	0.29	0.38	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
New Orleans, La.	1	10:27 a. m.	12:45 p. m.	1.17	11:39 a. m.	11:57 a. m.	0.04	0.39	0.72	0.99	1.07	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	12	5:17 p. m.	6:20 p. m.	1.31	5:21 p. m.	5:58 p. m.	0.01	0.14	0.20	0.31	0.66	0.98	1.15	1.24	1.28	.....	.....	.....	.....	.....	.....
New York, N. Y.	7	6:35 p. m.	7:35 p. m.	1.36	7:00 p. m.	7:20 p. m.	0.02	0.10	0.39	0.90	1.32	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Norfolk, Va.	12–13	10:55 p. m.	6:10 a. m.	3.86	3:25 a. m.	5:19 a. m.	0.50	0.12	0.18	0.23	0.27	0.30	0.35	0.53	0.74	0.87	1.03	1.45	2.12	2.65	3.27
Do	29–30	8:20 p. m.	D. N.	1.17	10:19 p. m.	11:21 p. m.	0.01	0.12	0.17	0.18	0.22	0.28	0.42	0.48	0.56	0.79	0.89	1.03	.....	.....	.....
Northfield, Vt.	27	3:30 p. m.	6:10 p. m.	1.07	3:54 p. m.	4:27 p. m.	0.05	0.13	0.37	0.46	0.53	0.57	0.63	0.73	.....	.....	.....	.....	.....	.....	.....
North Head, Wash	31	.....	.....	0.02	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.01	.....	.....	.....
Oklahoma, Okla.	7–8	9:00 p. m.	7:15 a. m.	1.98	9:52 p. m.	10:52 p. m.	0.02	0.12	0.16	0.24	0.47	0.53	0.57	0.65	0.89	1.15	1.31	1.41	.....	.....	.....
Do	23	6:30 p. m.	D. N.	2.00	6:45 p. m.	7:48 p. m.	0.02	0.12	0.23	0.26	0.37	0.46	0.62	0.70	0.72	0.79	0.80	1.13	.....	.....	.....
Omaha, Nebr.	6	5:20 a. m.	7:15 a. m.	0.85	6:43 a. m.	7:05 a. m.	0.26	0.10	0.35	0.48	0.56	0.58	.....	.....	.....	.....	.....	.....	.....	.....	.....
Palestine, Tex.	6	.....	.....	0.33	.....	.....	.....	.....	.....	.....	.....	.....	0.33	.....	.....	.....	.....	.....	.....	.....	.....
Parkersburg, W. Va.	8	5:55 p. m.	8:26 p. m.	1.26	5:56 p. m.	6:11 p. m.	0.01	0.25	0.69	1.05	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Pensacola, Fla.	27	2:30 p. m.	2:55 p. m.	0.39	2:37 p. m.	2:51 p. m.	0.03	0.09	0.25	0.36	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Peoria, Ill.	21	.....	.....	0.45	.....	.....	.....	.....	.....	.....	.....	.....	0.39	.....	.....	.....	.....	.....	.....	.....	.....
Philadelphia, Pa.	24–25	11:45 p. m.	11:00 a. m.	3.03	§12:19 a. m.	12:55 a. m.	0.01	0.09	0.18	0.32	0.49	0.64	0.72	0.77	0.80	.....	.....	.....	.....	.....	.....
					‖ 4:35 a. m.	5:45 a. m.	1.67	0.12	0.26	0.32	0.37	0.41	0.43	0.46	0.50	0.57	0.63	0.75	0.90	.....	.....
Pittsburg, Pa.	17	6:20 a. m.	7:55 a. m.	0.71	7:03 a. m.	7:17 a. m.	0.13	0.14	0.36	0.52	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Portland, Me	23	5:23 p. m.	6:20 p. m.	0.71	5:24 p. m.	5:34 p. m.	0.01	0.32	0.57	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Portland, Oreg.	12	.....	.....	0.05	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.03	.....	.....	.....
Pueblo, Colo.	5	2:48 p. m.	5:32 p. m.	0.70	3:20 p. m.	3:41 p. m.	0.01	0.19	0.32	0.51	0.61	0.65	.....	.....	.....	.....	.....	.....	.....	.....	.....
Raleigh, N. C.	12	D. N.	7:10 a. m.	1.11	5:12 a. m.	6:02 a. m.	0.03	0.19	0.28	0.29	0.30	0.44	0.49	0.66	0.79	0.90	0.01	.....	.....	.....	.....
Do	21	5:28 p. m.	7:46 p. m.	1.38	5:34 p. m.	7:10 p. m.	0.02	0.10	0.15	0.20	0.24	0.35	0.47	0.51	0.55	0.66	0.70	0.71	1.11	1.31	.....
Richmond, Va.	1	3:58 a. m.	6:35 a. m.	1.04	4:32 a. m.	5:07 a. m.	0.11	0.15	0.28	0.33	0.54	0.72	0.77	0.90	.....	.....	.....	.....	.....	.....	.....
Rochester, N. Y.	6	.....	.....	0.35	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.35	.....	.....	.....
Sacramento, Cal.	11	.....	.....	T.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
St. Louis, Mo	26	9:36 a. m.	1:55 p. m.	0.80	9:38 a. m.	10:03 a. m.	T.	0.05	0.25	0.37	0.50	0.65	.....	.....	.....	.....	.....	.....	.....	.....	.....
St. Paul, Minn	22	.....	.....	0.47	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.44	.....	.....	.....
Salt Lake City, Utah	19–20	.....	.....	0.72	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.35	.....	.....	.....
San Antonio, Tex.	12	3:50 p. m.	4:20 p. m.	0.50	3:54 p. m.	4:09 p. m.	0 01	0.13	0.42	0.49	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
San Diego, Cal.	20	.....	.....	0.08	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.03	.....	.....	.....
Sandusky, Ohio	7	1:05 p. m.	2:20 p. m.	2.25	1:15 p. m.	2:05 p. m.	0.01	0.26	0.49	0.78	1.34	1.59	1.74	1.98	2.11	2.16	2.22	.....	.....	.....	.....
Do	8	10:33 a. m.	12:15 p. m.	1.59	10:33 a. m.	11:13 a. m.	0.01	0.18	0.23	0.36	0.59	0.86	1.08	1.26	1.33	.....	.....	.....	.....	.....	.....
San Francisco, Cal.	30	.....	.....	0.08	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Savannah, Ga	27	3:31 p. m.	8:20 p. m.	1.98	§ 3:50 p. m.	4.21 p. m.	0.04	0.15	0.28	0.39	0.49	0.57	0 64	0.69	.....	.....	.....	.....	.....	.....	.....
					‖ 7:01 p. m.	7:29 p. m.	1.09	0.22	0.41	0.51	0.66	0.77	0.83	... .	.....	.....	.....	.....	.....	.....	.....
Do	28	7:21 p. m.	8:20 p. m.	0.78	7:37 p. m.	7:58 p. m.	0.02	0.26	0.43	0.57	0.72	0.74	.....	.....	.....	.....	.....	.....	.....	.....	.....
Scranton, Pa	8	.....	.....	0.38	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.37	.....	.....	.....
Seattle, Wash	12	.....	.....	0.11	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.11	.....	.....	.....
Shreveport, La.	5	5:10 p. m.	7:45 p. m.	0.65	5:16 p. m.	5:32 p. m.	0.01	0.13	0.30	0.41	0.44	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	17	4:20 p. m.	5:25 p. m.	0.51	4:32 p. m.	4:44 p. m.	0.02	0.18	0.33	0.40	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Spokane, Wash.	13	.....	.....	0.25	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.14	.....	.....	.....
Springfield, Ill.	5	1:48 p. m.	5:04 p. m.	1.06	2:05 p. m.	2:27 p. m.	0.01	0.11	0.37	0.63	0.82	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	17	5:04 p. m.	D. N.	0.95	6:10 p. m.	6:32 p. m.	0.01	0.15	0.24	0.41	0.59	0.64	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	26	7:45 a m.	12:41 p. m.	1.38	7:47 a. m.	8:24 a. m.	0.01	0.11	0.32	0.42	0.53	0.59	0.67	0.74	.....	.....	.....	.....	.....	.....	.....
Springfield, Mo.	7–8	11:06 p. m.	1:54 p. m.	2.27	3:47 a. m.	4:26 a. m.	0.26	0.30	0.45	0.58	0.67	0.83	0.91	0.97	1.07	.....	.....	.....	.....	.....	.....
Syracuse, N. Y.	6	2:12 p. m.	3:10 p. m.	0.69	2:49 p. m.	3:03 p. m.	0.02	0.35	0.59	0.67	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	20	2:40 p. m.	4:18 p. m.	0.63	3:12 p. m.	3:24 p. m.	0.01	0.14	0.41	0.47	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Tampa, Fla	3	12:08 p. m.	4:10 p. m.	1.67	12:23 p. m.	12:53 p. m.	0.01	0.22	0.81	1.11	1.28	1.41	1.49	.....	.....	.....	.....	.....	.....	.....	.....
Do	31	7:00 p. m.	9:12 p. m.	0.86	7:01 p. m.	7:31 p. m.	0.01	0.25	0.43	0.56	0.63	0.67	0.79	.....	.....	.....	.....	.....	.....	.....	.....
Taylor, Tex.	21	5:15 p. m.	5:50 p. m.	0.59	5:22 p. m.	5:35 p. m.	T.	0.21	0.42	0.58	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Thomasville, Ga.	21	7:17 p. m.	10:55 p. m.	1.09	8:32 p. m.	8:57 p. m.	0.06	0.14	0.46	0.65	0.80	0.89	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	23	8:12 a. m.	12:20 p. m.	2.09	9:29 a. m.	11:20 a. m.	0.33	0.06	0.14	0.24	0.27	0.39	0.45	0.48	0.48	0.49	0.62	0.83	1.14	1.51	1.75
Toledo, Ohio	27	.....	.....	0.53	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.37	.....	.....	.....
Topeka, Kans.	4	4:06 p. m.	6:35 p. m.	2.37	4:22 p. m.	5:55 p. m.	0.01	0.29	0.42	0.47	0.66	0.68	0.74	0.95	1.24	1.45	1.47	1.51	2.06	2.32	.....
Valentine, Nebr.	3	2:57 p. m.	4:56 p. m.	0.99	3:35 p. m.	3:48 p. m.	0.11	0.17	0.42	0.47	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	8	1:42 a. m.	2:46 a. m.	0.89	1:52 a. m.	2:35 a. m.	0.03	0.14	0.20	0.28	0.46	0.53	0.58	0.66	0.77	0.83	.....	.....	.....	.....	.....
Vicksburg, Miss	11	1:40 p. m.	2:25 p. m.	1.00	1:43 p. m.	2:18 p. m.	0.01	0.17	0.35	0.45	0.66	0.86	0.94	0.99	.....	.....	.....	.....	.....	.....	.....
Do	18	5:50 p. m.	7:32 p. m.	1.17	5:52 p. m.	6:17 p. m.	0.01	0.23	0.62	0.90	0.99	1.07	.....	.....	.....	.....	.....	.....	.....	.....	.....
Washington, D. C.	2	3:50 p. m.	6:00 p. m.	1.17	3:50 p. m.	4:25 p. m.	0.00	0.09	0.15	0.41	0.66	0.87	1.03	1.08	.....	.....	.....	.....	.....	.....	.....
Do	7	5:10 p. m.	6:40 p. m.	1.06	5:15 p. m.	5:35 p. m.	T.	0.27	0.72	0.90	1.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	21	7:28 p. m.	8:45 p. m.	1.71	7:35 p. m.	8:00 p. m.	T.	0.20	0.62	1.18	1.42	1.61	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	24	1:30 p. m.	8:00 p. m.	2.58	2:02 p. m.	3:00 p. m.	T.	0.11	0.30	0.57	0.79	0.90	0.97	1.30	1.73	2.10	2.30	2.48	.....	.....	.....
Wichita, Kans.	31	.....	.....	0.76	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.56	.....	.....	.....
Wilmington, N. C.	1	11:00 a. m.	1:35 p. m	0.69	12:34 p. m.	12:42 p. m.	0.14	0.31	0.42	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Wytheville, Va.	15–16	8:03 p. m.	1:10 a. m.	2.83	§ 8:05 p. m.	8:24 p. m.	0.02	0.12	0.28	0.39	0.46	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
					‖ 9:24 p. m.	10:34 p. m.	0.85	0.11	0.25	0.50	0.68	0.84	0.95	1.04	1.09	1.16	1.28	1.68	1.87	.....	.....
Yankton, S. Dak	23	D. N.	8:25 a. m.	2.12	4:32 a. m.	5:11 a. m.	0.34	0.15	0.37	0.63	0.93	1.18	1.29	1.41	1.56	.....	.....	.....	.....	.....	.....
San Juan, Porto Rico	12	D. N.	7:35 a. m.	0.55	5:14 a. m.	5:24 a. m.	0.01	0.21	0.42	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	27	1:19 p. m.	1:55 p. m.	0.68	1:28 p. m.	1:47 p. m.	0.05	0.07	0.27	0.51	0.61	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

Self-register not working

TABLE V.—*Data furnished by the Canadian Meteorological Service, August, 1906.*

Stations.	Pressure, in inches.			Temperature.				Precipitation.			Stations.	Pressure, in inches.			Temperature.				Precipitation.		
	Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hours.	Departure from normal.	Mean.	Departure from normal.	Mean maximum.	Mean minimum.	Total.	Departure from normal.	Total snowfall.		Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hours.	Departure from normal.	Mean.	Departure from normal.	Mean maximum.	Mean minimum.	Total.	Departure from normal.	Total snowfall.
	Ins.	*Ins.*	*Ins.*	°	°	°	°	*Ins.*	*Ins.*	*Ins.*		*Ins.*	*Ins.*	*Ins.*	°	°	°	°	*Ins.*	*Ins.*	*Ins.*
St. Johns, N. F.	29.72	29.85	—.11	57.8	— 2.0	64.9	50.7	2.43	—1.65		Parry Sound, Ont	29.32	30.00	+.02	68.8	+ 5.3	79.4	58.1	4.51	+1.79	
Sydney, C. B. I.	29.90	29.94	—.01	65.8	+ 2.5	75.2	56.4	2.63	—0.99		Port Arthur, Ont.	29.29	30.00	+.04	61.5	+ 2.0	71.0	52.0	2.34	—0.41	
Halifax, N. S.	29.90	30.00	+.04	66.8	+ 3.2	76.7	56.8	1.52	—2.83		Winnipeg, Man	29.14	29.96	+.02	65.1	+ 1.7	77.1	53.1	1.33	—1.34	
Grand Manan, N. B	29.91	29.96	+.01	65.3	+ 3.8	74.0	56.6	1.14	—2.52		Minnedosa, Man	28.16	29.94	.00	63.6	+ 4.2	76.4	50.9	0.75	—1.35	
Yarmouth, N. S	29.95	30.02	+.05	61.5	+ 1.3	69.4	53.6	1.08	—2.93		Qu'Appelle, Sask	27.70	29.91	—.02	63.8	+ 2.3	77.2	50.5	0.64	—1.00	
Charlottetown, P. E. I.	29.92	29.96	+.02	67.1	+ 2.8	75.4	58.7	1.47	—2.27		Medicine Hat, Alberta.	27.62	29.86	—.06	67.3	+ 1.6	81.7	53.0	2.16	+0.49	
Chatham, N. B	29.90	29.92	—.01	68.8	+ 5.6	81.7	55.9	3.13	—0.91		Swift Current, Sask.	27.42	29.94	+.01	65.0	+ 1.0	78.7	51.2	1.64	—0.27	
Father Point, Que.	29.90	29.92	+.01	58.4	+ 2.8	67.3	49.6	2.90	—0.15		Calgary, Alberta	26.46	29.94	+.03	59.5	+ 0.1	74.0	45.0	3.00	+0.86	
Quebec, Que.	29.65	29.97	+.04	66.5	+ 3.4	76.6	56.4	3.18	—0.65		Banff, Alberta	25.44	29.97	+.06	55.6	— 0.7	70.2	41.1	2.26	—0.27	
Montreal, Que.	29.78	29.98	+.03	70.7	+ 4.3	78.7	62.7	1.45	—2.12		Edmonton, Alberta.	27.65	29.90	—.02	60.0	+ 1.2	74.0	46.0	0.81	—1.32	
Rockliffe, Ont.	29.39	29.99	+.03	67.0	+ 3.8	79.3	54.6	1.81	—1.14		Prince Albert, Sask.	28.33	29.87	—.05	59.9	+ 1.0	72.4	47.4	1.13	—1.02	
Ottawa, Ont	.....	.....	.....	.....	.....	.....	.....	.....	.....		Battleford, Sask.	28.20	29.92	+.01	63.8	+ 1.2	79.5	48.1	1.04	—1.32	
Kingston, Ont.	29.70	30.00	+.02	69.6	+ 2.6	77.7	61.5	1.45	—0.93		Kamloops, B. C.	28.67	29.86	—.05	70.8	+ 2.2	85.9	55.8	T.	—1.09	
Toronto, Ont	29.62	29.98	—.01	71.8	+ 5.8	81.2	62.6	1.83	—0.93		Victoria, B. C.	29.90	29.99	—.02	62.3	+ 3.6	72.9	51.7	0.53	—0.07	
White River, Ont	28.72	30.01	+.05	60.8	+ 4.4	74.8	46.7	2.05	—1.25		Barkerville, B. C.	25.78	30.08	+.18	52.7	— 3.6	64.9	40.5	1.30	—1.80	
Port Stanley, Ont	29.36	29.99	—.01	71.7	+ 5.8	80.7	62.7	7.02	+4.60		Hamilton, Bermuda.	30.00	30.16	+.06	80.4	+ 0.8	85.9	74.8	4.46	—1.62	
Saugeen, Ont.	29.31	30.01	+.02	69.3	+ 5.5	78.1	60.5	1.78	—0.47		Dawson, Yukon	28.68	.....	.....	54.0	.....	67.8	40.2	1.46	.....	

TABLE VI.—*Heights of rivers referred to zeros of gages, August, 1906.*

Stations.	Distance to mouth of river.	Flood stage on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.	Stations.	Distance to mouth of river.	Flood stage on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.						Height.	Date.	Height.	Date.		
Milk River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*	*Little Kanawha River.*	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Havre, Mont.	237	9	2.7	1, 22-24	2.4	14-21	2.5	0.3	Glenville, W. Va.	77	20	3.0	16	0.0	7	1.9	3.0
Yellowstone River.									Creston, W. Va.	38	20	5.6	9	1.3	4, 6	3.3	4.3
Billings, Mont.	330	8	2.5	7, 26	1.7	19-21	2.1	0.8	*New-Great Kanawha River.*								
Cheyenne River.									Radford, Va	213	14	11.0	29	0.6	11	2.6	10.4
Rousseau, S. Dak (*)	7	9	6.5	9	0.3	4-6	2.5	6.2	Hinton, W. Va.	153	14	8.1	30	2.3	10	3.5	5.8
James River.									Charleston, W. Va.	58	30	11.2	31	5.5	28	7.1	5.7
Lamoure, N. Dak	330	14	1.5	2, 3	0.5	30-31	1.0	1.0	*Scioto River.*								
Huron, S. Dak	139	9	1.4	17-19	0.7	30, 31	1.0	0.7	Columbus, Ohio	110	17	5.7	18	2.4	4, 15-17	3.2	3.3
Republican River.									*Licking River.*								
Clay Center, Kans.	42	18	8.4	8	5.8	5	6.5	2.6	Falmouth, Ky.	30	25	4.9	18	1.8	31	2.9	3.1
Smoky Hill-Kansas River.									*Miami River.*								
Abilene, Kans.	277	22	2.6	1	0.3	26	1.1	2.3	Dayton, Ohio	77	18	3.0	9	0.7	7	1.6	2.3
Manhattan, Kans.	116	18	7.2	8	3.0	29-31	4.4	4.2	*Kentucky River.*								
Topeka, Kans	87	21	12.3	5	6.3	31	7.7	6.0	Jackson, Ky.	287	24	6.8	16	4.8	3-7, 26, 27	5.2	2.0
Missouri River.									Beattyville, Ky	254	30	3.0	21	0.1	4-7	1.1	2.9
Townsend, Mont	2,504	11	4.0	27, 28	3.2	{6-11, 14, } {18-21 }	3.5	0.8	High Bridge, Ky.	117	17	11.0	16	9.3	4-7	10.0	1.7
Fort Benton, Mont	2,285	12	0.7	1, 2	0.0	18-21	0.3	0.7	Frankfort, Ky.	65	31	7.8	16	5.8	5	6.5	2.0
Wolfpoint, Mont.	1,952	17	—0.2	3	—1.6	20-23	—1.1	1.4	*Wabash River.*								
Bismarck, N. Dak.	1,309	14	3.7	31	0.6	29	2.1	3.1	Mount Carmel, Ill.	75	15	3.2	29, 30	0.8	6-11	1.7	2.4
Pierre, S. Dak.	1,114	14	4.5	10	1.5	31	2.9	3.0	*Cumberland River.*								
Sioux City, Iowa	784	19	10.1	13	7.3	31	8.6	2.8	Burnside, Ky.	518	50	10.2	1	2.6	28	4.0	7.6
Omaha, Nebr.	669	18	9.3	16	8.0	24, 25	8.7	1.3	Celina, Tenn.	383	45	11.6	2	3.8	30	6.1	7.8
St. Joseph, Mo	481	10	6.5	10	3.2	27	4.8	3.3	Carthage, Tenn.	308	40	9.1	2	3.3	31	5.0	5.8
Kansas City, Mo.	388	21	13.4	11	9.0	30	11.2	4.4	Nashville, Tenn.	193	40	12.7	4	9.2	14, 16	10.2	3.5
Glasgow, Mo.	231	18	9.7	14	7.0	31	8.5	2.7	Clarksville, Tenn.	126	42	12.9	21	6.0	17, 18, 25	8.1	6.9
Boonville, Mo.	199	20	14.0	13	10.2	2-4	12.0	3.8	*Powell River.*								
Hermann, Mo.	103	24	12.2	14, 27	9.3	24	10.5	2.9	Tazewell, Tenn.	44	20	7.0	17	0.8	16	1.8	6.2
Minnesota River.									*Clinch River.*								
Mankato, Minn.	127	18	7.7	29, 30	4.1	7	6.1	3.6	Speers Ferry, Va.	156	20	5.1	16	0.6	8, 30	2.0	4.5
St. Croix River.									Clinton, Tenn	52	25	12.0	18	5.6	11, 12	7.6	6.4
Stillwater, Minn.	23	11	8.0	31	5.1	9-11	6.3	2.9	*South Fork Holston River.*								
Chippewa River.									Bluff City, Tenn.	35	12	3.4	15	1.2	29	2.0	2.2
Chippewa Falls, Wis.	75	16	4.5	25	1.0	3	1.9	3.5	*Holston River.*								
Red Cedar River.									Rogersville, Tenn.	103	14	5.1	30	2.5	9, 11, 13	3.1	2.6
Cedar Rapids, Iowa	77	14	5.0	12	3.3	5, 6	3.8	1.7	*French Broad River.*								
Des Moines River.									Asheville, N. C.	144	4	3.2	31	0.1	12, 13	1.0	3.1
Des Moines, Iowa	205	19	5.5	15	1.8	5-9	3.4	3.7	Leadvale, Tenn.	70	12	7.0	30	1.3	11	2.5	5.7
Illinois River.									*Little Tennessee River.*								
La Salle, Ill	197	18	12.7	25	11.2	1-3, 6-8	11.6	1.5	McGhee, Tenn.	17	20	7.2	31	3.9	12, 13	4.8	3.3
Peoria, Ill.	135	14	8.5	30, 31	7.1	1	7.4	1.4	*Hiwassee River.*								
Clarion River.									Charleston, Tenn	18	22	10.7	31	1.6	24	3.9	9.1
Clarion, Pa.	32	10	2.0	21	— 0.8	5, 6	0.4	2.8	*Tennessee River.*								
Conemaugh River.									Knoxville, Tenn.	635	12	9.8	31	2.1	12, 13	4.2	7.7
Johnstown, Pa.	64	7	5.8	20	0.8	6	2.3	5.0	Loudon, Tenn.	590	25	7.5	31	2.5	13, 14	4.0	5.0
Allegheny River									Kingston, Tenn.	556	25	8.5	31	2.9	13	4.5	5.6
Warren, Pa	177	14	0.1	11, 12	— 0.5	21, 22	—0.1	0.6	Chattanooga, Tenn.	452	33	9.7	31	4.7	14	7.0	5.0
Franklin, Pa	114	15	2.3	21	0.2	6	0.9	2.1	Bridgeport, Ala	402	24	6.6	3	3.2	14	5.0	3.4
Parker, Pa.	73	20	3.1	21	0.2	4-6	1.2	2.9	Guntersville, Ala.	349	31	11.7	4	6.4	14	8.4	5.3
Freeport, Pa.	29	20	9.0	22	1.0	5, 6	3.9	8.0	Florence, Ala.	255	16	6.2	5	3.4	16	4.6	2.8
Springdale, Pa	17	27	12.7	22	5.9	5	8.3	6.8	Riverton, Ala.	225	26	10.1	5	6.0	17	7.6	4.1
Cheat River.									Johnsonville, Tenn.	95	21	9.3	1	5.8	18, 19	7.2	3.5
Rowlesburg, W. Va.	36	14	4.2	10	1.6	6	2.4	2.6	*Ohio River.*								
Youghiogheny River.									Pittsburg, Pa.	966	22	9.5	11	3.6	15	6.0	5.9
Confluence, Pa.	59	10	8.0	10	0.5	1, 2	2.0	7.5	Davis Island Dam, Pa.	960	25	10.7	11	2.6	3, 4	5.5	8.1
West Newton, Pa.	15	23	11.7	10	0.0	2, 3	2.8	11.7	Beaver Dam, Pa	925	27	15.6	11	3.2	4, 7	7.5	12.4
Monongahela River.									Wheeling, W. Va.	875	36	15.3	12	2.8	5	7.1	12.5
Weston, W. Va.	161	18	0.4	10, 28	— 0.6	6, 7	—0.1	1.0	Parkersburg, W. Va.	785	36	14.0	13	3.2	7, 8	7.9	10.8
Fairmont, W. Va.	119	25	16.3	11	14.3	4-7	15.2	2.0	Point Pleasant, W. Va.	703	39	14.4	14	3.8	7	8.5	10.6
Greensboro, Pa	81	18	9.8	11	6.8	6, 7	8.0	3.0	Huntington, W. Va	660	50	18.1	14	6.9	6	12.2	11.2
Lock No. 4, Pa.	40	28	10.8	11, 12	7.5	30, 31	8.7	3.3	Catlettsburg, Ky.	651	50	17.9	15	5.6	8	11.5	12.3
Beaver River.									Portsmouth, Ohio	612	50	18.7	15	7.3	7, 8	12.8	11.4
Ellwood Junction, Pa.	10	14	6.7	11	2.6	31	3.7	4.1	Maysville, Ky.	559	50	18.0	16	7.0	8	12.6	11.0
Muskingum River.									Cincinnati, Ohio	499	50	20.2	17	9.0	9, 10	14.4	11.9
Zanesville, Ohio	70	25	10.7	24	7.9	5-7	9.2	2.8	Madison, Ind	413	46	17.0	18	8.1	8	12.4	8.9
Beverly, Ohio	20	25	8.5	21	4.5	8	6.4	4.0	Louisville, Ky.	367	28	8.0	18, 19	3.9	10	5.9	4.1
									Evansville, Ind.	184	35	15.3	20	6.9	11-13	10.7	8.4

TABLE VI.—*Heights of rivers referred to zeros of gages*—Continued.

Stations.	Distance to mouth of river.	Flood stage on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Ohio River—Cont'd.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Mount Vernon, Ind	148	35	14.2	21	6.3	11, 13	9.9	7.9
Paducah, Ky.	47	40	12.8	23	7.8	13–15	10.2	5.0
Cairo, Ill.	1	45	20.7	1	16.3	12, 13	18.4	4.4
St. Francis River.								
Marked Tree, Ark.	104	17	4.5	26–28	1.9	10, 11	3.0	2.6
Neosho River.								
Neosho Rapids, Kans.	326	22	7.4	9	1.0	28–31	2.3	6.4
Iola, Kans.	262	10	2.9	11	0.1	22, 26	0.8	2.8
Oswego, Kans.	184	20	6.1	7	0.6	25–28, 31	1.9	5.5
Fort Gibson, Ind. T.	3	22	16.0	11	10.9	4	11.9	5.1
Canadian River.								
Calvin, Ind. T.	99	10	14.0	7	2.9	23, 30	4.5	11.1
Black River.								
Blackrock, Ark.	67	12	9.2	27	2.8	5–7	5.6	6.4
White River.								
Calicorock, Ark	272	15	9.4	14	0.7	6–8	3.8	8.7
Batesville, Ark.	217	18	11.0	15	2.5	8	5.9	8.5
Newport, Ark.	185	26	14.5	15, 16	2.5	8, 9	7.7	12.0
Clarendon, Ark.	75	30	19.6	31	10.0	10, 11	15.2	9.6
Arkansas River.								
Pueblo, Colo	1334	10	3.6	24	3.0	29–31	3.2	0.6
Wichita, Kans.	832	10	0.4	12	— 1.0	29	—0.3	1.4
Tulsa, Ind. T.	551	16	7.6	9	3.4	22, 23	4.6	4.2
Webbers Falls, Ind. T.	465	23	14.4	11	6.2	23, 24, 31	8.6	8.2
Fort Smith, Ark.	403	22	19.2	10	6.8	24	10.6	12.4
Dardanelle, Ark.	256	21	18.3	10	6.3	1, 8	10.4	12.0
Little Rock, Ark.	176	23	18.5	11, 12	7.3	9	11.4	11.2
Pine Bluff, Ark.	121	23	20.6	13	9.6	10	13.8	11.0
Yazoo River.								
Greenwood, Miss.	175	38	9.5	1	2.7	24	4.4	6.8
Yazoo City, Miss.	80	25	7.1	2	— 0.6	28, 29	1.8	7.7
Ouachita River.								
Camden, Ark.	304	39	20.8	3	5.8	27	8.8	15.0
Monroe, La	122	40	14.9	8	3.9	31	8.6	11.0
Red River								
Arthur City, Tex.	688	27	23.0	13	9.0	31	14.0	14.0
Fulton, Ark.	515	28	27.4	18	11.8	9	19.3	15.6
Shreveport, La.	327	29	15.4	22, 23	5.4	11, 12	11.2	10.0
Alexandria, La.	118	33	18.5	26, 27	7.9	1, 15	13.7	10.6
Mississippi River.								
Fort Ripley, Minn.	2,082	10	6.0	28–30	4.7	20, 22	5.4	1.3
St. Paul, Minn.	1,954	14	8.4	31	5.3	8	6.6	3.1
Red Wing, Minn.	1,914	14	5.8	31	3.6	7, 8	4.3	2.2
Reeds Landing, Minn.	1,884	12	5.5	31	3.4	7, 8	4.1	2.1
La Crosse, Wis.	1,819	12	6.0	30, 31	4.6	8, 9	5.1	1.4
Prairie du Chien, Wis.	1,759	18	6.5	31	5.1	{4–6, 10, 15–17}	5.5	1.4
Dubuque, Iowa	1,699	18	6.5	20	5.1	16	5.7	1.4
Clinton, Iowa	1,629	16	6.8	7	4.9	16, 17	5.6	1.9
Leclaire, Iowa	1,609	10	4.5	8	3.1	17, 18	3.8	1.4
Davenport, Iowa	1,593	15	6.2	8, 10	4.6	17–19	5.2	1.6
Muscatine, Iowa	1,562	16	7.2	11, 12	5.7	6, 19, 20	6.2	1.5
Galland, Iowa	1,472	8	3.5	12, 13	2.5	7, 8	2.9	1.0
Keokuk, Iowa.	1,463	15	5.8	12, 13	4.3	6–8	5.0	1.5
Warsaw, Ill.	1,458	18	8.6	13	7.2	7, 8	7.9	1.4
Hannibal, Mo	1,402	13	6.7	14, 18	5.1	8–10	5.9	1.6
Grafton, Ill	1,306	23	8.2	20	6.9	9, 10	7.5	1.3
St. Louis, Mo	1,264	30	13.6	15, 16	10.1	7	11.6	3.5
Chester, Ill	1,189	30	11.3	15, 17, 29	9.0	6, 7, 26	10.0	2.3
New Madrid, Mo.	1,003	34	17.3	1	13.4	12–14	15.0	3.9
Luxora, Ark	905	33	10.5	1	6.5	13, 14	8.0	4.0
Memphis, Tenn	843	33	14.9	1	10.2	15, 16	11.8	4.7
Helena, Ark.	767	42	20.4	2	14.4	16, 17	16.6	6.0
Arkansas City, Ark.	635	42	24.3	2, 3	18.8	11	21.7	5.5
Greenville, Miss.	595	42	19.7	3	15.2	12	17.6	4.5
Vicksburg, Miss.	474	45	21.2	4, 5	16.5	13	18.9	4.7
Natchez, Miss.	373	46	22.9	6	18.9	14, 15	20.9	4.0
Baton Rouge, La.	240	35	14.2	9	11.2	15, 16	12.6	3.0
Donaldsonville, La	188	28	9.6	8	7.7	1, 2, 15, 16	8.6	1.9
New Orleans, La.	108	16	6.5	9	5.5	1–3	6.0	1.0
Atchafalaya River.								
Simmesport, La.	127	33	18.3	7, 8	15.0	15	17.0	3.3
Melville, La.	103	31	21.8	22	18.9	15	20.6	2.9
Morgan City, La	19	8	4.6	4	3.0	3, 6, 15, 17	3.6	1.6
Grand River.								
Grand Rapids, Mich.	38	11	2.1	12	1.3	3, 7	1.6	0.8
Sandusky River.								
Tiffin, Ohio	65	8	1.2	11	0.3	4–6, 17–22	0.5	0.9
Connecticut River.								
Hartford, Conn.	50	16	3.4	5–7, 9	1.3	20	2.6	2.1
Mohawk River.								
Tribeshill, N. Y.	42	12	0.6	31	— 0.6	17, 18	0.0	1.2
Schenectady, N. Y.	19	15	1.3	8, 9	0.4	18–20	0.8	0.9
Hudson River.								
Troy, N. Y.	154	14	3.2	10	— 0.4	19	2.4	3.6
Albany, N. Y.	147	12	4.6	7, 8, 23	1.0	13	3.1	3.6
Pompton River.								
Pompton Plains, N. J.	6	8	4.9	4	3.8	19–24	4.3	1.1
Passaic River.								
Chatham, N. J	69	7	3.7	1, 4	2.3	26, 30, 31	2.9	1.4
Lehigh River.								
Mauch Chunk, Pa.	45	15	5.0	4	4.2	{16, 20, 21 24–27}	4.4	0.8
Schuylkill River.								
Reading, Pa.	66	12	3.7	4	0.1	18–21	0.6	3.6
Delaware River.								
Hancock (E. Branch), N. Y.	269	12	4.7	28	2.8	17–20	3.3	1.9
Hancock (W. Branch), N. Y.	269	10	4.6	8	2.6	19	3.3	2.0
Port Jervis, N. Y.	204	14	1.9	29	0.1	19–21	0.9	1.8
Phillipsburg, N. J.	142	26	3.1	4	0.8	20	1.8	2.3
Trenton, N. J.	92	18	2.7	5, 6	1.2	22, 23	1.8	1.5

Stations.	Distance to mouth of river.	Flood stage on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
North Branch Susquehanna.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Binghamton, N. Y.	183	16	3.5	29	1.9	19, 20	2.3	1.6
Towanda, Pa	139	16	2.6	9	0.7	3, 4	1.5	1.9
Wilkes-Barre, Pa.	60	17	5.0	10	2.8	20, 21	3.7	2.2
West Branch Susquehanna.								
Renovo, Pa.	90	16	5.0	12	0.5	2, 3	1.9	4.5
Williamsport, Pa.	39	20	5.8	12	1.2	3	2.3	4.6
Susquehanna River.								
Harrisburg, Pa.	69	17	3.7	13	1.6	3, 20	2.3	2.1
Shenandoah River.								
Riverton, Va.	58	22	3.5	30	— 0.5	1–16	0.9	4.0
Potomac River.								
Cumberland, Md.	290	8	7.2	9	2.4	1	4.6	4.8
Harpers Ferry, W. Va.	172	18	9.0	11	0.0	1	5.1	9.0
James River.								
Buchanan, Va.	305	12	4.6	29	2.3	5, 6	3.5	2.3
Lynchburg, Va.	260	18	6.0	29	0.8	6, 7	2.4	5.2
Columbia, Va.	167	18	11.6	18	4.0	7	6.8	7.6
Richmond, Va.	111	12	3.3	30	0.3	5	1.4	3.0
Dan River.								
Danville, Va.	55	8	5.8	17	0.2	12	1.3	5.6
Roanoke River.								
Clarksville, Va	196	12	7.6	18	0.5	11	3.3	7.1
Weldon, N. C.	129	30	37.2	30	10.0	13	20.2	27.2
Tar River.								
Tarboro, N. C	46	25	22.1	23	3.0	10	11.2	19.1
Greenville, N. C.	21	22	15.8	24	3.6	13	9.9	12.2
Haw River.								
Moncure, N. C.	171	25	18.8	31	8.3	11, 12	11.8	10.5
Cape Fear River.								
Fayetteville, N. C.	112	38	40.5	30	5.0	11	17.7	35.5
Waccamaw River.								
Conway, S. C.	40	7	6.4	5, 6	5.0	28–31	5.8	1.4
Pedee River.								
Cheraw, S. C	149	27	27.6	31	3.0	11, 12	12.7	24.6
Smiths Mills, S. C.	51	16	14.3	9–12	10.0	19	12.9	4.3
Lynch Creek.								
Effingham, S. C.	35	12	11.0	4, 5	5.2	23	7.6	5.8
Black River.								
Kingstree, S. C.	45	12	10.1	4	6.2	16–18	7.9	3.9
Catawba-Wateree River.								
Mount Holly, N. C.	143	15	9.0	30	1.8	9–12	3.1	7.2
Catawba, S. C	107	11	15.4	31	2.3	11	5.2	13.1
Camden, S. C.	54	24	27.1	31	7.3	12, 13	.....	19.8
Broad River.								
Blairs, S. C	36	14	14.0	3	1.5	11	4.1	12.5
Saluda River.								
Pelzer, S. C.	109	7	6.3	30	3.2	20	3.9	3.1
Chappels, S. C.	56	14	16.0	3	3.0	13	6.7	13.0
Congaree River.								
Columbia, S. C.	52	15	17.2	3	1.5	12	4.8	15.7
Santee River.								
Rimini, S. C	108	10	15.6	7	10.5	13	13.0	5.1
St. Stephens, S. C.	50	10	10.0	11	8.3	19, 20	8.9	1.7
Edisto River.								
Edisto, S. C.	75	6	5.6	3–6	4.2	1	5.0	1.4
Broad River.								
Carlton, Ga.	30	11	8.2	19	2.4	12	3.8	5.8
Savannah River.								
Calhoun Falls, S. C.	347	15	6.6	2	3.0	10, 12, 13	4.1	3.6
Augusta, Ga.	268	32	19.5	1	8.7	12, 13	12.3	10.8
Oconee River.								
Milledgeville, Ga.	147	25	11.3	17	3.4	12	5.9	7.9
Dublin, Ga	79	30	8.9	4	1.4	13	4.7	7.5
Ocmulgee River.								
Macon, Ga.	203	18	11.2	15	3.0	12	5.9	8.2
Abbeville, Ga.	96	11	8.0	5	3.8	15, 16	6.4	4.2
Flint River.								
Woodbury, Ga.	227	10	3.5	5, 16	0.6	21	1.7	2.9
Montezuma, Ga.	152	20	8.0	9, 31	4.1	8	6.0	3.9
Albany, Ga.	90	20	6.2	27	3.2	7, 17	4.8	3.0
Bainbridge, Ga.	29	22	9.2	1	5.6	24	6.8	3.6
Chattahoochee River.								
Oakdale, Ga	305	18	12.0	21	3.4	27	5.1	8.6
West Point, Ga.	239	20	8.2	15	3.6	11, 27	5.2	4.6
Eufaula, Ala	90	40	16.5	23	4.0	11, 12	8.0	12.5
Alaga, Ala. [a]	30	25	14.6	17	6.2	11	9.0	8.4
Coosa River.								
Rome, Ga.	266	30	6.4	7	3.0	{13, 14, 23 25–27}	4.1	3.4
Gadsden, Ala.	162	22	7.5	1	3.4	14	4.8	4.1
Lock No. 4, Ala.	113	17	6.4	1	2.8	25	4.2	3.6
Wetumpka, Ala	12	45	15.5	15	6.6	26, 27	10.0	8.9
Tallapoosa River.								
Milstead, Ala.	42	35	15.3	15	2.7	25	5.4	12.6
Alabama River.								
Montgomery, Ala.	323	35	12.9	16	4.0	27	7.4	8.9
Selma, Ala	246	35	15.0	17	5.0	28	9.2	10.0
Black Warrior River.								
Tuscaloosa, Ala.	90	43	18.5	16	6.3	27	9.4	12.2
Tombigbee River.								
Columbus, Miss	316	33	—1.1	16	— 2.8	10, 11	—2.2	1.7
Vienna, Ala.	246	42	3.6	8	1.6	24–27	2.2	2.0
Demopolis, Ala.	168	35	9.3	18	0.6	28, 29	3.7	8.7
Pascagoula River.								
Merrill, Miss.	78	20	4.8	18	1.6	31	2.9	3.2
Pearl River.								
Columbia, Miss.	110	14	4.4	7	3.4	26–31	3.8	1.0
Sabine River.								
Logansport, La.	315	25	18.3	3	4.2	17	8.6	14.1
Neches River.								
Rockland, Tex	105	20	5.3	2	0.0	30, 31	2.6	5.3
Beaumont, Tex.	18	10	1.8	9	0.7	29	1.4	1.1

TABLE VI.—*Heights of rivers referred to zeros of gages*—Continued.

Stations.	Distance to mouth of river.	Flood stage on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Trinity River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Dallas, Tex.	320	25	29.3	14, 15	5.4	31	12.8	23.9
Long Lake, Tex.	211	35	25.4	10	8.6	31	20.8	16.8
Riverside, Tex.	112	40	13.4	12	7.4	31	11.3	6.0
Liberty, Tex.	20	25	14.5	10	10.3	20	13.1	4.2
Brazos River.								
Kopperl, Tex.	345	21	5.6	8	1.0	28–31	2.7	4.6
Waco, Tex.	285	24	10.8	13	4.1	31	6.3	6.7
Valley Junction, Tex.	215	40	12.0	14	3.6	31	5.4	8.4
Hempstead, Tex.	140	40	14.1	15	3.0	31	6.5	11.1
Booth, Tex.	61	39	5.7	9, 16	4.1	28–31	4.6	1.6
Colorado River.								
Ballinger, Tex.	489	21	31.0	6	1.8	{1–4, 20–26, 30, 31}	2.1	29.2
Austin, Tex.	214	18	19.5	12	2.4	7–9	5.7	17.1
Columbus, Tex.	98	24	33.5	15	7.6	8	14.6	25.9
Guadalupe River.								
Gonzales, Tex.	112	22	0.8	{13, 14, 22–24}	0.3	6–8	0.5	0.5
Victoria, Tex.	53	16	1.8	2	0.8	29, 30	1.3	1.0
Rio Grande River.								
San Marcial, N. Mex.	1,233	14	8.9	1	7.0	25	7.9	1.9
El Paso, Tex.	1,030	14	9.6	5	6.1	20, 28	7.3	3.5
Red River of the North.								
Moorhead, Minn.	284	26	11.5	6	10.4	17	11.0	1.1
Kootenai River.								
Bonners Ferry, Idaho.	123	24	7.8	1, 2	3.5	30, 31	5.2	4.3
Pend d'Oreille River.								
Newport, Wash.	86	14	2.2	1	0.1	26–31	0.8	2.1
Snake River.								
Lewiston, Idaho	144	24	2.0	1, 2	−0.3	29–31	0.5	2.3
Riparia, Wash.	67	30	2.3	3	0.4	23	1.3	1.9
Columbia River.								
Wenatchee, Wash.	473	40	20.8	1	11.3	31	15.6	9.5
Umatilla, Oreg.	270	25	9.5	1	4.8	31	6.9	4.7
The Dalles, Oreg.	166	40	14.0	1	6.6	31	9.9	7.4
Willamette River.								
Albany, Oreg.	118	20	1.4	1	0.8	17-26,30,31	1.0	0.6
Salem, Oreg.	84	20	0.0	1, 2	−0.4	28–31	−0.2	0.4
Portland, Oreg.	12	15	7.5	2	3.5	27, 28	5.2	4.0
Sacramento River.								
Red Bluff, Cal.	201	23	1.4	1–4	0.7	30, 31	1.2	0.7
Sacramento, Cal.	64	25	12.0	2, 3	8.8	31	10.4	3.2

(a) 1 day missing. (c) 3 days missing.

Honolulu, T. H., latitude 21° 19′ north, longitude 157° 52′ west; barometer above sea, 38 feet; gravity correction, —0.057 inch, applied. August, 1906.

Day.	Pressure.a		Air temperature.				Moisture.				Wind.				Precipitation.		Clouds.					
							8 a. m.		8 p. m.		8 a. m.		8 p. m.				8 a. m.			8 p. m.		
	8 a. m.	8 p. m.	8 a. m.	8 p. m.	Maximum.	Minimum.	Wet.	Relative humidity.	Wet.	Relative humidity.	Direction.	Velocity.	Direction.	Velocity.	8 a. m.	8 p. m.	Amount.	Kind.	Direction.	Amount.	Kind.	Direction.
1	30.03	30.03	80.0	78.1	84	75	70.0	61	70.8	70	e.	3	ne.	8	0.00	0.00	5	Cu.	e.	4	Cu.	e.
2	30.06	30.06	79.0	78.0	84	74	72.4	73	69.0	63	e.	7	ne.	9	0.01	0.01	8	Cu.	e.	6	Cu.	e.
3	30.08	30.05	80.2	77.0	84	74	68.2	54	70.0	71	e.	17	ne.	16	0.00	0.00	1	Cu.	e.	1	S.-cu.	e.
																				2	Cu.	ne.
																				1	Cu.	e.
4	30.05	29.97	78.0	76.0	83	74	67.3	57	69.0	70	ne.	10	ne.	10	0.01	T.	4	Cu.	e.	8	S.	ne.
5	29.98	29.97	76.0	78.0	81	71	69.4	72	69.0	63	ne.	5	ne.	7	0.04	T.	4	Cu.	e.	3	S.	ne.
6	29.99	29.99	77.5	79.0	83	72	71.0	72	71.0	68	ne.	4	ne.	12	0.10	T.	6	Cu.	e.	4	Cu.	e.
7	29.99	29.99	78.0	78.0	82	74	72.5	77	73.0	79	e.	7	ne.	12	0.11	0.08	8	Cu.	e.	9	S.	e.
8	30.04	30.02	79.7	78.0	85	74	73.2	74	72.0	75	e.	9	ne.	8	0.05	T.	4	Cl.-cu.	0	1	Cu.	e.
																	4	Cu.	e.			
9	30.01	29.98	79.0	78.8	84	75	73.0	75	70.8	68	ne.	3	ne.	5	0.00	T.	5	Cu.	e.	few.	Cu.	e.
10	30.01	30.01	77.2	75.0	84	74	69.5	68	71.0	82	ne.	9	ne.	10	0.00	0.02	3	Cu.	e.	5	Cu.	e.
																				1	N.	e.
11	30.02	29.98	79.0	77.0	83	73	72.0	71	69.0	67	e.	11	sw.	8	0.05	0.00	4	Cu.	e.	0	0	0
12	30.02	29.99	78.5	77.0	84	74	70.0	66	71.0	74	ne.	10	ne.	5	0.00	T.	1	Cu.	e.	10	N.	e.
13	29.98	29.97	79.0	77.0	83	74	72.0	71	70.0	71	ne.	4	e.	9	T.	T.	4	Cu.	e.	few.	S.-cu.	ne.
14	29.98	29.96	76.0	77.3	84	74	71.0	78	70.3	71	se.	6	ne.	8	0.00	T.	8	Cu.	e.	0	0	0
15	29.96	29.96	80.0	77.0	84	74	70.0	61	69.0	67	se.	4	ne.	3	0.00	0.00	3	Cu.	e.	0	0	0
16	29.94	29.92	79.0	77.0	84	75	69.0	60	70.0	71	e.	10	ne.	6	0.00	0.00	2	Cu.	e.	0	0	0
17	29.93	29.93	80.0	78.0	84	73	72.0	68	70.0	67	e.	3	ne.	8	T.	0.00	1	Cl.-cu.	0	0	0	0
																	3	Cu.	e.			
18	29.96	29.96	80.0	78.0	84	75	70.3	62	70.0	67	ne.	13	ne.	5	0.00	T.	1	Cl.	0	1	Cu.	e.
																	4	Cu.	e.			
19	29.98	29.96	81.0	78.0	84	76	70.0	58	71.5	73	ne.	6	ne.	3	0.00	T.	6	Cl.	0.	2	N.	e.
																	1	Cu.	e.			
20	29.99	29.96	79.0	77.7	84	73	69.0	60	68.5	62	e.	6	e.	9	0.03	T.	1	Cl.-cu.	0.	0	0	0
																	2	Cu.	e.			
21	30.00	29.98	79.3	77.2	83	75	68.4	57	68.2	63	ne.	7	ne.	10	0.00	T.	1	Cu.	e.	0	0	0
22	29.99	29.96	78.0	77.0	84	72	70.0	67	69.0	67	e.	9	e.	6	0.06	0.00	7	Cu.	e.	4	Cu.	e.
																				2	S.	e.
23	29.98	29.97	80.0	77.2	83	72	70.0	61	68.2	63	e.	5	e.	5	0.03	T.	0	Lt. haze.	0	few.	S.	e.
																	2	Cu.	e.			
24	30.00	29.98	78.0	78.1	84	73	69.0	63	70.1	67	e.	11	e.	5	T.	0.02	4	Cl.-cu.	e.	1	A.-cu.	nw.
																	3	Cu.	e.	6	S.-cu.	ne.
25	30.00	29.98	80.0	77.2	84	74	70.0	61	68.0	62	e.	10	e.	15	T.	0.00	6	Cu.	e.	2	Cu.	e.
26	29.98	29.97	78.0	77.0	82	73	68.2	61	69.0	67	e.	12	ne.	10	T.	T.	1	Cu.	e.	1	A.-s.	0
27	30.00	29.99	79.4	77.0	83	75	69.0	59	68.0	63	ne.	4	ne.	15	0.00	0.00	1	Cu.	e.	1	Cu.	e.
28	30.01	29.96	79.0	76.0	83	74	69.0	60	69.0	70	e.	8	e.	12	0.00	T.	4	Cl.	0.	2	Cu.	e.
																	2	Cu.	e.			
29	29.96	29.94	79.0	77.0	84	74	68.5	58	68.5	65	ne.	6	ne.	11	0.00	0.00	1	Cu.	e.	3	A.-cu.	se.
																				1	Cu.	e.
30	29.98	29.98	79.0	78.0	84	74	70.0	64	69.0	63	ne.	4	e.	10	0.02	0.00	3	Cu.	e.	2	Cu.	e.
31	30.02	30.02	79.5	77.5	84	76	69.0	58	68.5	63	ne.	9	ne.	10	0.00	0.00	3	Cl.	0	6	Cu.	e.
																	1	Cu.	e.			
Mean.	29.997	29.980	78.9	77.4	83.5	73.9	70.1	64.7	69.7	68.1	e.	7.5	ne.	8.7	0.51	0.13	4.3	Cu.	e.	2.9	Cu.	e.

Observations are made at 8 a. m. and 8 p. m., local standard time, which is that of 157° 30′ west, and is 5h and 30m slower than 75th meridian time. aPressure values are reduced to sea level and standard gravity.

CLIMATOLOGICAL DATA FOR MERZIFOUN, ASIA MINOR, FOR THE YEARS 1904 AND 1905.[1]

Contributed by Prof. J. J. MANISSADJIAN, Observer.

In continuation of tables published in the MONTHLY WEATHER REVIEW for January, 1903, p. 25, and for March, 1904, p. 118, I take pleasure in presenting the following summary of monthly and annual values observed at Anatolia College, Merzifoun, latitude 40° 51′ north; longitude 35° 31′ east; altitude 751 meters, or 2464 feet.

[In preparing these data for publication, the final decimal figure which appeared in the table received has frequently been increased by one to state the value to the *nearest* digit, instead of the *whole* digit. Other changes have been made as stated in footnotes.—EDITOR.]

[1] A similar summary for the year 1903 may be found in the MONTHLY WEATHER REVIEW, Vol. XXXII, No. 3 (March, 1904, issue), pp. 117-118; for the years 1892-1902 less complete records were printed in the REVIEW, June, 1897, Vol. XXV, p. 245, and January, 1903, Vol. XXXI, p. 25.

Meteorological records of Anatolia College, Merzifoun, Asia Minor.

1904.	Air pressure (in millimeters).[a]					Air temperature (in degrees centigrade).										
	Average.	Absolute.				7 a. m.	1:45 p. m.	9 p. m.	Average.				Absolute maximum.	Date.	Absolute minimum.	Date.
		Maximum.	Date.	Minimum.	Date.				Daily.[b]	Maxima.	Minima.	Daily range.				
January	694.9	699.0	26	690.0	12	— 5.3	— 0.9	— 3.9	— 3.5	0.2	— 6.0	6.2	4.5	3	—13.0	14, 15
February	691.1	698.3	5	682.8	24	1.5	8.2	3.7	4.3	9.3	0.8	8.5	14.0	16	— 6.0	5
March	690.7	697.2	9	682.4	22	— 0.3	6.0	1.9	2.4	7.5	— 0.7	8.2	15.5	16	— 4.5	4
April	690.5	696.7	14	684.0	29	7.3	12.6	7.2	8.6	14.0	3.1	10.9	21.5	22	— 6.0	17
May	691.1	694.9	27	688.4	31	13.5	16.2	10.9	[d]12.9	18.5	7.3	11.2	24.5	25	0.5	29
June	691.2	695.0	17	687.2	20	19.0	21.0	15.0	17.5	22.5	10.8	11.7	29.0	28	2.5	3
July	689.2	695.9	14	684.0	30	21.1	23.9	16.7	19.6	24.7	13.7	11.0	32.5	30	10.0	16
August	690.8	694.7	15	685.1	27	19.8	24.3	18.0	20.0	25.3	13.6	11.7	31.5	24	9.0	16
September	692.4	695.8	10	687.3	17	14.9	[e]23.1	14.1	[e]16.5	[e]21.7	10.2	[e]11.5	29.5	5	4.5	28
October	692 2	698.0	3	688.9	31	10.0	18.4	12.3	13.3	18.6	7.8	10.8	26.5	10	— 0.5	25
November	691.8	697.1	12	682.2	30	3.0	7.8	6.8	6.1	8.0	2.0	6.0	14.5	10	— 3.5	14
December	692.2	697.6	8	683.2	1	— 2.4	1.8	— 1.0	[e]— 0.6	2.6	— 2.8	5.4	8.0	16	—14.5	30
Total	8298.1	[f]8360.2	.....	[f]8225.5	.....	102.1	162.4	101.7	[g]117.1	172.9	59.8	113.1	[f]251.5	.....	[f]—21.5	.....
Average for the year	691.5	[f]696.7	.....	[f]685.5	.....	8.5	13.5	8.5	9.8	14.4	5.0	9.4	[f]21.0	.....	[f]— 1.8	.....
Annual extreme	.....	699.0	Jan. 26	682.2	Nov. 30	.....	.....	.....	.....	.....	.....	.....	32.5	July 30	—14.5	{Dec. 30

1904.	Cloudiness, 0-10.						Precipitation (in millimeters).					Wind, number of observations with—								
	7 a. m.	1:45 p. m.	9 p. m.	Average.[b]	Clear days (less than 2.)	Cloudy days (more than 8).	Total.	Maximum.	Date.	Days with 1 mm.[i]	Days with more than 2 mm.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.
January	5.5	6.9	5.1	5.8	7	12	6.0	6.0	12	0	1	9	2	0	1	0	1	0	1	79
February	5.2	7.2	3.9	5.4	5	6	21.0	9.2	3	4	4	0	0	2	0	4	14	4	0	63
March	8.6	8.2	7.5	8.1	0	20	55.5	25.0	16	1	7	8	7	0	6	1	8	6	9	48
April	6.5	6.0	4.0	5.5	6	9	24.6	11.0	13	2	4	24	7	2	0	5	1	6	2	43
May	5.5	6.7	5.3	5.8	3	8	93.5	36.5	14	1	8	24	9	0	0	0	2	1	1	56
June	2.5	3.6	2.8	3.0	16	4	20.7	6.2	1	2	4	32	13	1	1	0	0	0	0	43
July	2.9	3.5	1.5	[j]2.6	16	1	0.0	0.0	.....	0	0	11	42	11	0	1	2	1	2	23
August	2.6	3.6	2.8	3.0	11	1	3.1	3.1	2	0	1	10	46	3	3	1	8	2	5	15
September	4.6	4.4	3.0	4.0	11	1	37.0	22.0	23	0	3	8	23	6	8	2	6	6	8	23
October	5.4	5.3	3.3	4.7	8	5	30.8	24.0	31	0	2	9	10	13	5	2	3	6	15	30
November	6.5	7.8	5.9	6.7	5	14	58.8	18.8	18	0	8	6	14	4	4	6	8	21	4	23
December	6.5	7.3	5.5	6.4	5	11	9.0	2.1	21	1	1	10	2	7	4	8	8	19	1	34
Total	62.3	70.5	50.6	[k]61.0	93	92	360.0	.....	.....	11	43	151	175	49	32	30	61	72	48	480
Average for the year	5.2	5.9	4.2	5.1	7.7	7.7	30.0	.....	.....	0.9	3.6	12.6	14.6	4.1	2.7	2.5	5.1	6.0	4.0	40.0

1905.	Air pressure (in millimeters).[a]					Air temperature (in degrees centigrade).										
	Average.	Absolute.				7 a. m.	1:45 p. m.	9 p. m.	Average.				Absolute maximum.	Date.	Absolute minimum.	Date.
		Maximum.	Date.	Minimum.	Date.				Daily.[b]	Maxima.	Minima.	Daily range.				
January	692.87	702.5	20	685.2	8	— 4.91	— 0.12	— 2.82	— 2.67	0.79	— 5.87	[p]6.67	9.5	2	—11.5	21, 28
February	694.39	703.0	25	687.6	5	— 5.46	— 0.26	— 3.50	— 3.18	0.78	— 5.96	6.75	7.0	16	—12.5	12
March	689.67	694.5	11	684.5	20	1.64	7.88	3.51	4.13	9.24	0.54	8.69	19.5	27	— 4.5	7
April	689.63	697.2	10	680.4	23	7.48	12.68	7.20	[l]8.64	13.95	3.86	10.08	24.0	23	[q]5.0	27
May	691.36	696.6	9	685.1	21	13.58	17.44	11.74	[m]13.62	19.43	7.83	11.59	25.5	21, 25	[q]0.0	9
June	689.31	694.0	4	685.2	13	16.65	19.63	13.96	[n]16.05	21.93	10.90	11.03	25.0	30	7.5	2
July	690.23	693.6	2	686.8	30	21.45	23.22	16.80	19.57	24.87	13.14	[q]11.73	30.5	26	10.0	5
August	691.02	693.8	26	687.6	30	20.32	23.46	17.06	19.47	24.40	13.00	11.40	30.5	30	9.0	25, 26
September	692.11	697.2	7	687.6	19	15.66	20.56	14.51	16.31	21.80	10.61	11.18	26.5	1, 23	5.0	20
October	691.90	697.0	12	686.0	20	15.75	21.90	17.79	18.31	22.67	7.50	[r]15.17	29.0	10	— 4.0	31
November	694.00	700.3	22	684.3	13	13.00	18.33	15.10	[o]15.38	18.86	2.53	[o]16.33	22.0	17, 24	— 3.0	1
December	693.60	699.2	22	684.3	14	1.58	4.88	2.70	2.96	5.86	—3.30	[s]9.16	16.5	2	—13.0	23
Total	8300.09	[f]8368.9	.....	[f]8224.6	.....	116.74	169.60	114.05	128.59	184.58	54.78	[r]129.78	[f]265.5	.....	[f]—12.0	.....
Average for the year	691.67	[f]697.41	.....	[f]685.38	.....	9.73	14.13	9.50	10.72	15.38	4.56	10.82	[f]22.12	.....	[f]— 1.00	.....
Annual extreme	.....	703.0	Feb. 25	680.4	Apr. 23	.....	.....	.....	.....	.....	.....	.....	30.5	{July 26 Aug. 30}	—13.0	{Dec. 28

Meteorological records of Anatolia College, Merzifoun, Asia Minor—Continued.

1905.	Cloudiness, 0-10.						Precipitation (in millimeters).					Wind, number of observations with—[v]								
	7 a. m.	1:45 p. m.	9 p. m.	Average.[h]	Clear days (less than 2).	Cloudy days (more than 8).	Total.	Maximum.	Date.	Days with 1 mm.[i]	Days with more than 2 mm.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.
January	6.22	6.93	5.45	6.20	3	10	25.5	14.2	6	0	4	20	0	8	3	6	10	12	1	33
February	5.92	6.82	5.64	6.13	3	9	12.0	4.8	19	2	3	15	7	4	0	4	8	10	8	27
March	7.51	7.03	5.93	6.82	3	14	37.1	10.5	21	4	6	12	3	7	3	3	9	11	14	31
April	7.00	7.03	5.06	6.36	2	12	36.1	7.1	8	2	7	9	8	10	2	5	9	15	12	20
May	6.35	6.74	4.74	5.94	2	7	32.0	9.8	27	2	6	14	16	13	3	2	3	11	6	25
June	6.33	7.03	4.53	5.96	1	6	[x]142.6	[x]56.0	16	5	12	16	8	17	1	2	2	15	5	24
July	2.03	3.25	1.38	2.22	18	0	0.0	0.0	.....	0	[y]0	28	22	9	2	1	7	0	2	22
August	1.93	2.32	1.16	1.80	23	2	2.0	2.0	24	0	1	22	27	10	3	1	5	8	0	17
September	2.70	2.90	1.96	2.52	17	0	15.2	5.7	2	0	5	9	23	6	5	2	3	8	6	28
October	4.96	5.90	3.80	4.89	6	7	61.6	24.2	20	0	6	9	10	3	8	4	9	8	10	32
November	6.23	7.16	5.56	6.32	2	12	17.0	7.1	27	2	2	4	10	10	6	4	8	8	5	35
December	6.45	7.61	6.41	6.82	2	13	22.1	10.6	6	3	3	6	17	7	2	4	5	12	7	33
Total	63.63	70.72	51.62	61.98	82	92	407.2	.....	.....	20	55	164	151	104	38	38	78	118	76	327
Average for the year	5.30	5.89	4.30	5.16	6.83	7.67	33.93	.....	.....	1.67	4.58	13.67	12.58	8.67	3.17	3.17	6.50	9.83	6.33	27.25

[a] As to the reduction to standard gravity nothing is said; presumably the readings are reduced to 0° C., but not to standard gravity. (See Vol. XXXI, p. 25.)
[b] Found by formula 1/4 (7 a. m. + 1:45 p. m. + 9 p. m. + 9 p. m). In computing means for the year 1905, the three observations were given equal weight, but not in the years preceding.
[c] 23.1, mean temperature at 1:45 p. m. observation in September, 1904, and 21.7, mean daily maximum for the month, are discordant. Presumably either the daily mean, 16.5, or the daily range, 11.5, is erroneous.
[d] 12.6 in table received.
[e] —0.4 in table received.
[f] Sum, or mean, of the twelve monthly extremes. In the case of the minimum temperatures for 1905 there is some uncertainty. (See note.[a])
[g] 116.6 in table received.
[h] The three observations are given equal weight; therefore this mean is not a value for daylight cloudiness, nor yet for the full twenty-four hours.
[i] Apparently days on which the precipitation amounted to 1 mm., but did not exceed 2 mm.
[j] 2.0 in table received.
[k] 60.4 in table received.
[l] 8.83 in table received.
[m] 13.49 in table received.
[n] 16.01 in table received.
[o] 15.36 in table received.
[p] 0.67 in table received.
[q] 11.85 in table received.
[r] 15.50 in table received.
[s] 16.35 in table received.
[t] 9.14 in table received.
[u] 5.0, absolute minimum for April, 1905, is manifestly an erroneous figure, for the average of the daily minima, 3.86, is less. Perhaps the values of April and May should be transposed, or possibly the correct value for April is —5.0, or 0.5.
[v] 130.23 in table received.
[w] The wind record for one observation in February, 1905, appears to be lacking.
[x] The precipitation on June 16, 1905, 56.0 mm., appears to be the greatest amount for this station in one day, not only during this year, but during the full period of which records have reached us. The amount for June, 1905, 142.6 mm., seems also unequaled in past records of monthly totals for Merzifoun.
[y] 1 in table received.

RAINFALL IN JAMAICA.

Through the kindness of Dr. H. H. Cousins, chemist to the government of Jamaica and now in charge of the meteorological service of that island, we have received the following table.

The rainfall for August was therefore below the average for the whole island. The greatest fall, 21.40 inches, occurred at Fellowship, in the northeastern division; while the least, 0.97 inch, fell at Harmony Hall, in the northern division.

Comparative table of rainfall.

[Based upon the average stations only.]

AUGUST, 1906.

Divisions.	Relative area.	Number of stations.	Rainfall.	
			1906.	Average.
	Per cent.		*Inches.*	*Inches.*
Northeastern division	25	19	9.25	8.88
Northern division	22	47	4.38	4.47
West-central division	26	23	8.41	9.38
Southern division	27	33	5.87	5.84
Means	100		6.98	7.14